THESIS
FOR THE AWARD OF DEGREE OF
DOCTOR OF MEDICINE
SESSION 2020-2023

COMPARISON OF NEBULISATION WITH KETAMINE VS LIGNOCAINE FOR PREVENTION OF POST OPERATIVE SORE THROAT IN SURGERIES UNDER GENERAL ANAESTHESIA

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This is to certify that the thesis titled **"Comparison of nebulisation with Ketamine vs Lignocaine for prevention of post operative sore throat in General anaesthesia surgeries"** is abonafide genuine research work carried out by **Dr. ISHITA GOVIL** in partial fulfilment of the requirements for award of the degree of M.D. in the speciality of ANAESTHESIA AND CRITICAL CARE .

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"We have a right to perform our prescribed duty, but we are entitled to the fruits of action. We should never consider ourselves the cause of the results of our activities, and never be attached to not doing our duty."

To begin with, I would like to thank Almighty who bestowed upon me the skills and strength to embark upon and complete this project. I regard it to be an honor to be a part of Santosh Medical College & Hospital, for providing me endless opportunities, and the necessary infrastructure and resources to accomplish my research work.

My thesis " **COMPARISON OF NEBULISATION WITH KETAMINE VS LIGNOCAINE FOR PREVENTION OF POST OPERATIVE SORE THROAT IN SURGERIES UNDER GENERAL ANAESTHESIA**" is a joint effort of a number of individuals, who with their technical competence and work have largely contributed to it. I take this rare opportunity to acknowledge the efforts of each who have helped in their own special way through this journey .

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INTRODUCTION

The management of the airway has always been crucial to the practise of anaesthesia, and it comprises all airway manipulations needed to complete the procedure. Airway management includes endotracheal intubation as a key component. Endotracheal tubes with cuffs are known to prevent aspiration and are therefore very commonly used in the airway management . Common sequelae to cuffed endotracheal intubation includes local irritation, inflammation of the airway.

Following extubation, the patient experiences severe case of hoarseness, painful throat, and cough which can be extremely distressing to the patient at times . These complications may leave the patient uncomfortable and with an unpleasant experience post operatively .[1]

One of the most frequent adverse effects post extubation is sore throat[2], which usually lingers for 12 - 24 hours after the operation . It (POST) has been seen to occur in about 21-65% of patients receiving general anaesthesia (GA) with tracheal intubation. Although considered as a minor complication , it may cause significant post-operative morbidity and patient dissatisfaction[3]. Irritation and inflammation of the airway is one of the mainstay cause for post operative sore throat [4].

The severity of POST is seen to be at its peak two to four hours after extubation and decreases gradually in 24 hours[5]. When anticipated intubation is essential in elective cases performed under general anesthesia , it may be helpful to give drugs prophylactically to alleviate postoperative sore throat and minimise patient discomfort post operatively . The aetiology of POST is however multifactorial, including the choice of airway device, high Endotracheal Tube (ETT) cuff pressure, surgical manipulation of the airway, airway suctioning and the type and length of surgery . Preoperative risk factors such as asthma or dry cough increases the probability of developing POST . [6]

Any intervention involving insertion of a definitive airway device under vision puts the airway at a risk of trauma . While we make attempts at intubation , it causes hyper activation of the pain pathways in response [7]. We often expose the airway to complications like trauma to the posterior pharynx, increased blood and secretions in

the airway, edema of the subglottic structures which can make subsequent intubations more difficult or even lead to complete airway obstruction[8].

This eventually leads to an increase in the incidence of post operative discomfort to the patient . If not managed appropriately , it could lead to complications which can prove to be even fatal at times .

Nebulization therapy is widely used to prevent POST. It is a highly recommended therapy as small volume of drugs is required for desirous effect , is an better patient compliance, an uncomplicated method of administration, and, most significantly, extremely minimal risk of of any adverse events as compared to other methods(such as gargle, intravenous, etc)[9] Commonly used aerosolized drugs have included corticosteroids, ketamine, magnesium, lidocaine, Non-steroidal anti-inflammatory drugs(NSAIDs) to achieve desired effects[20,10,11,12]. Despite the continuing clinical trials on POST nebulization therapy, there is still no authentic data available for the relevant drugs. There is a lack of direct comparisons between frequently used aerosolized drugs and a lack of a clinically useful ranking of all nebulising drugs with respect to both efficacy as well as acceptability.

Judicious use of adjuvant agents, such as nonsteroidal anti-inflammatory drugs, lidocaine, and beclomethasone , ketamine , magnesium sulphate, may improve postoperative analgesia and diminish analgesic-related side effects[13]

We have undertaken a study to compare the effect of ketamine nebulisation pre operatively and compared it with lignocaine nebulisation preoperatively[19] in order to conclude the best agent with maximum effects and least adverse effects out of the two for prevent post-operative sore throat , hoarseness and cough and provide patient satisfaction post operatively .

AIMS AND OBJECTIVES

- To determine the efficacy of nebulisation with ketamine for prevention of the post operative sore throat (POST) .

- To determine the efficacy of nebulisation with lignocaine for prevention of the post operative sore throat (POST) .

- To compare the efficacy of ketamine nebulisation with lignocaine nebulisation pre operatively for prevention of the post operative sore throat (POST) .

- To compare the cardiovascular changes after nebulization in both the groups pre operatively

- To compare hoarseness and cough Post operatively

SAMPLE SIZE CALCULATION

STATISTICS: (n) =

SAMPLE SIZE CALCULATION :

$$n= 2*[z_{\alpha}+z_{1-\beta}]^2*p*q/d^2$$

Z_{α} =1.96 at 5% level of significant.

Z_{β} = 1.28 at 90 % power of test.

P= (pl+p2)/2 ; P1=40 ; P2 = 10

q=1-p= 1-30 = 70

d=effect size. = 30

After putting the values in the above formula and adding 10% dropout rate ,

SAMPLE SIZE : (n) = 40.8

By using the above-mentioned parameters, the minimum required sample size was rounded off and taken as 40 subjects in each of the two study groups. A total of 80 subjects were included for the final analysis.

Mean and standard deviation : mention

Study groups:

Group K – Patients received Ketamine Nebulisation (n = 40)

Group L – Patients received Lignocaine nebulisation (n = 40)

Statistical Analysis:

The data collected during the study was compiled using a Microsoft Excel spread sheet and analyzed statistically using the statistical package for the MedCalc statistical Software version 20.115 for window editions. Qualitative data were presented as number, percentage and Quantitative data were presented as mean±SD and median. Comparison between groups was done by $\chi 2$-test and unpaired t test. A P value of 0.05 or less was regarded as statistically significant.

Consort flow chart

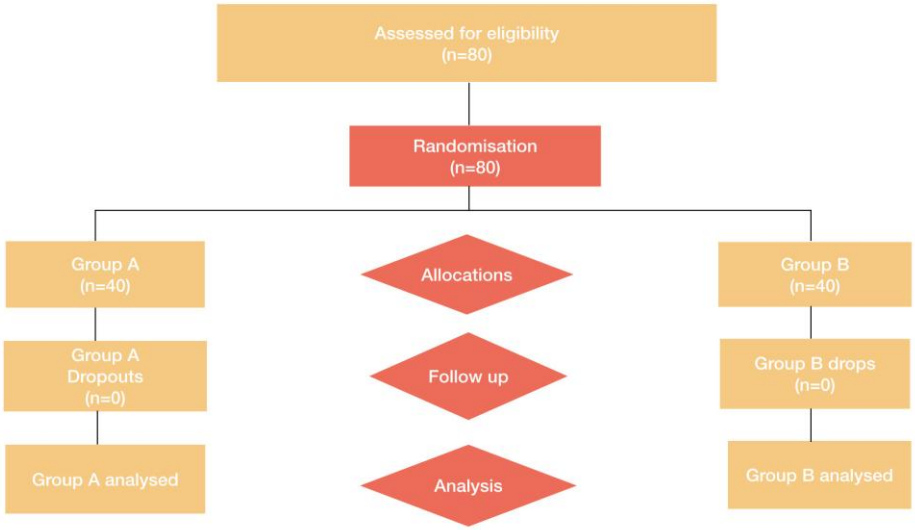


Figure 1: Consort Flow Chart

GROUP K- Patients were given nebulisation with Ketamine 50mg with 4ml of normal saline, 20 mins before induction.

GROUP L – Patients were given lignocaine 2% 2ml with 2ml of normal saline nebulization 20 mins before induction.

MATERIALS AND METHOD

Study Design: Randomised Controlled Study.

Place of study: The study was conducted from November 2020-November 2021 at the Department of Anaesthesiology, Santosh Hospitals, Ghaziabad, UP.

Study Population: Patients undergoing surgical procedures under General Anaesthesia performed with endotracheal intubation with controlled ventilation were taken up for study.

INCLUSION CRITERIA:

1. ASA grade I and II.
2. Patients aged 18–60 years of either sex
3. Patients scheduled for elective surgeries under general anesthesia undergoing endotracheal intubation .
4. MPG I & II

EXCLUSION CRITERIA:

1.Allergy to Ketamine , Lignocaine

2. Patients with history of gastroesophageal reflux disease, asthma and reactive airway disease .

METHODOLOGY

After obtaining approval from institutional ethics committee for 80 adult patients of either sex belonging to ASA grade I and grade II admitted to Santosh Medical College, Ghaziabad, for surgery planned by various departments to be performed under general anaesthesia(planned for endotracheal intubation), were randomly divided into 2 groups of 40 each. The patients were allocated into 2 groups , using a computer generated randomisation table . - group K and group L. Group K (n=40) included patients who received Ketamine nebulisation and Group L (n=40) included patients received Lignocaine nebulization pre operatively 20 minutes before the induction of anaesthesia . Group K received nebulisation with Ketamine 50mg with

4ml of normal saline, 20 mins before induction. Group L received nebulisation with Lignocaine 2% 2ml with 2ml of normal saline, 20 mins before induction.

PREANESTHETIC CHECKUP:

A thorough pre-anaesthetic examination was done a day prior to the surgery and written informed consent was taken from all the patients. Physical examination and airway examination including Modified Malampatti grading and Mouth opening were assessed . All required routine haematological, biochemical & radiological investigations, electrocardiogram appropriate for the surgery were done. ASA grading of the patients were done. A pre operative visit was made to allay the anxiety and to develop a good rapport with the patient . Tab alprazolam 0.25 mg was advised the night before surgery . The patients were instructed to fast overnight . Aspiration prophylaxis was advised with Tablet Ranitidine 150 mg the night before the surgery .

METHOD

On the day of surgery, the patients were examined in the pre operative room and the pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) were recorded as a part of the assessment when the patient arrived in the pre operative receiving area . Patients were randomly assigned into two groups of 40 each, GROUP K and GROUP L using a computer generated randomisation chart .

GROUP K- Patients were given nebulisation with Ketamine 50mg with 4ml of normal saline, 20 mins before induction.

GROUP L – Patients were given lignocaine 2% 2ml with 2ml of normal saline nebulization 20 mins before induction.

An 18 Gauge intravenous cannula was secured pre operatively and crystalloid infusion was started. The rate of infusion was set as per the Holliday- Segar rule and fluid therapy was initiated. The patient vitals were recorded including the blood pressure and heart rate. After the first recording of the vitals, the patient was nebulised with the drug 20 minutes prior to induction. The vitals were recorded after nebulisation i.e after 20 minutes. The patient was taken to the operating room. On arrival in the operating room, patients ’heart rate, blood pressure, oxygen saturation,

electrocardiogram and capnography were monitored with a non-invasive multipara monitor. All patients received injection ondansetron 4 mg IV followed by inj Tramadol (50mg)i.v pre induction as pre medication . Pre oxygenation was performed for 3 minutes with 100% oxygen. 2 mg/kg of Inj. Propofol was administered intravenously to halt the eye-lash reflex, Inj. Vecuronium 0.1 mg/kg was injected intravenously . Controlled positive pressure ventilation was done with 100% oxygen using bag and mask . Direct laryngoscopy and tracheal intubation was performed by an experienced anaesthesiologist . The application of lignocaine jelly on the endotracheal tube was not advocated during my study in order to assess the results better as local application of jelly will provide local relief to the patient and interfere with the outcomes of my study . The tube size chosen varied between 7.5 to 8.0 mm cuffed tube . The endotracheal tube's cuff was immediately filled with just enough room air to prevent a detectable air leak after intubation. Throughout the procedure, intracuff pressure was kept between 18 & 22 cm H2O (within the green zone) using a handheld pressure gauge. Anaesthesia was maintained with isoflurane, fentanyl, top ip dose of vecuronium (0.01mg/kg) and supplemented with oxygen 33% in nitrous oxide. The patients were mechanically ventilated using circle system to maintain the normocapnia. At the completion of the procedure, anaesthesia was withdrawn. At the end of surgery, residual neuromuscular paralysis was antagonised with neostigmine 0.05 mg.kg−1 and glycopyrrolate 0.01 mg.kg−1. On emergence of the patients from under the influence of aesthetic agents , they were extubated Before extubation, oropharyngeal suction was performed under direct vision to minimise tissue trauma as well as to ensure that the secretion has been cleaned. Patients once extubated , they were propped up and taken to the post-anesthesia care unit (PACU) and observed for upto 24 hours. Regarding post-operative complaints, the patients were interrogated. If they did not mention sore throat complaints, a leading question was subsequently posed to them following the surgery. In the PACU, patients were assessed for post operative sore throat at 2 hrs , 8 hrs , 12 hrs and 24 hrs .

FOLLOWING OBSERVATIONS WERE MADE:

Heamodynamic parameters (HR andBP) were recorded for all patients initially on arrival(baseline parameters before nebulisation of patient) and 20 minutes after nebulisation .

Post Operative Sore Throat (POST) based on the four point scale was observed:

Post Severity Score:

Grade 1: no sore throat

Grade 2: mild sore throat when asked

Grade 3: moderate complaint of sore throat without question

Grade 4: severe sore throat along with throat pain

At intervals: Immediately after extubation, 2 hrs after extubation, 8 hrs after extubation, 12 hrs and 24 hrs after extubation. Cardiovascular parameters i.e blood pressure and heart were also recorded for both groups of the patients receiving nebulized ketamine and nebulized lignocaine – pre nebulization, 15 minutes after nebulization and immediately before induction .

If there were any other adverse effects, they included coughing, hoarseness, dry mouth, and nausea/vomiting. A four-point scale was used to rate hoarseness (0-3) No complaints of hoarsness at all after surgery; minor changes in speech (complains of hoarsness only when asked); moderate changes in speech quality (complains of hoarsness on one's own); and severe changes in the observer's perception of voice quality (numbers 0 through 3).

REVIEW OF LITERATURE

REVIEW OF CLINICAL ANATOMY :

STRUCTURE AND FUNCTION OF THE UPPER AIRWAYS[47]

The passage through which air passes into and out of lungs during respiration is defined as airway. Airway divided into an upper airway and lower airway.

Upper airway consists of

- Mouth, nasopharynx, oropharynx and larynx.

Lower airway comprises of

- Trachea,
- Bronchi,
- Bronchioles
- Alveoli

NOSTRILS:

They are external pyramid like openings of the nasal cavity . It is present as free tip and a root at its junction with the forehead. Alae nasi are the lateral margins of the nostril. The distances from alae nasi to various points on the external ears are used to estimate the length of airway devices. The framework of the nose has formed by some bones and cartilages. The upper part is supported by bones like nasal bone, frontal process of maxillary bone and nasal part of frontal bone.

NASAL CAVITY:

Nasal cavity is a large triangular air filled space with an irregular surface. It is separated into two cavities, right and left halves by nasal septum. Each halves of nasal cavity extends from anterior nares to nasopharynx posteriorly. It is the part of airway with least dimensions making it the narrowest part of the upper airway. The roof of the cavity is formed by the cribriform plate of ethmoid. The floor of the cavity is formed by the palatine process of maxilla and palatine bone. The lateral wall is irregular due to presence of 3 conchae. It has opening of paranasal sinus. The

important function of the nasal cavity is warming and humidification of air as it passes through the nose.

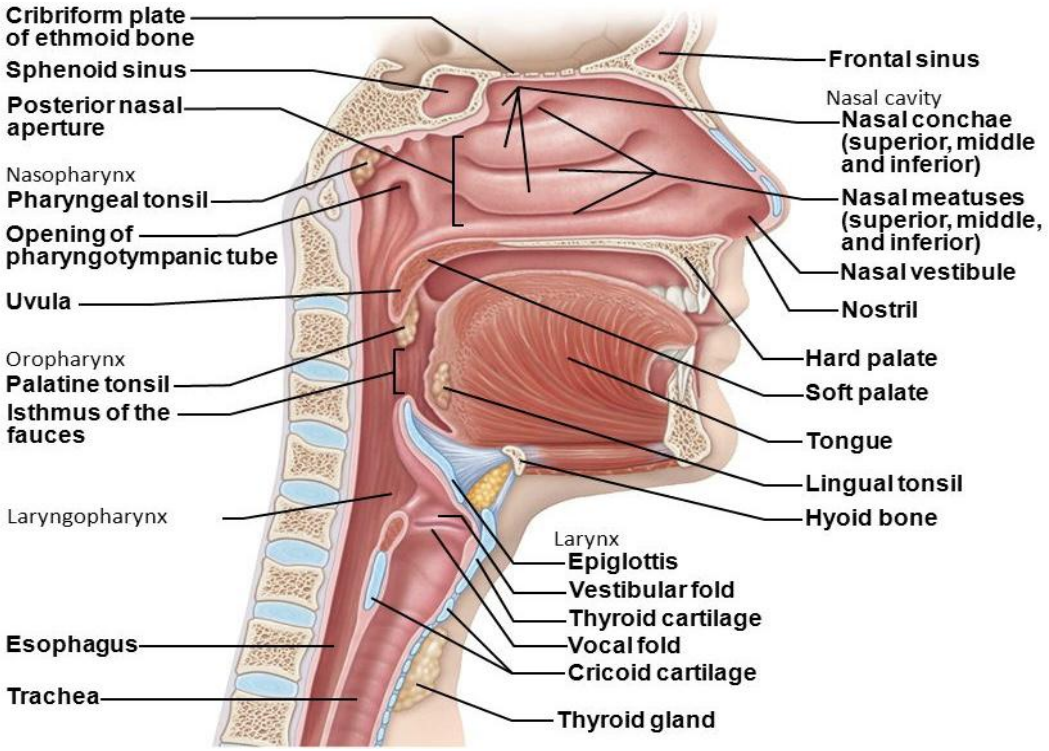


Figure 2: Lateral View of Nasal, Oral Pharynx and Larynx

PHARYNX:

The pharynx is a fibro muscular structure. It extends from the base of the skull up to the level of the 6th cervical vertebra or cricoid cartilage. It continues with the oesophagus and larynx.

Pharynx divided into

- Nasopharynx

- Oropharynx

NASOPHARYNX:

It extends above from the base of skull up to the level of soft and hard palate below. It communicates with nasopharynx through the posterior nares. It consists of the nasal cavity, septum, turbinate's and adenoids. It is posteriorly bounded by the C1 and C2 vertebral body.

OROPHARYNX:

Oropharynx extends from hard and soft palate above to hyoid bone below. Below it is bounded by base of the tongue up to the epiglottis. It includes the tonsils, uvula and epiglottis. The valecula is the space between epiglottis and the base of the tongue and has paired depressions of the two sides of the median glossoepiglottic fold.

Laryngoscope blade tip lies in vallecula during classical laryngoscopy. Upward pressure with laryngoscopy blade on the vallecula produces the elevation of larynx and alignment of pharyngeal and laryngeal axes.

LARYNX:

It spans between the laryngeal inlet and the lower edge of the cricoids cartilage. It acts as an organ of voice and protects the lower airway as an inlet valve from the contents of the GIT. It is located between the C3 and C6 vertebral bodies. It moves vertically and anteroposteriorly during swallowing and phonation. Larynx includes cartilages which are paired and unpaired. The thyroid, cricoid, and epiglottis constitute the three unpaired cartilages. While paired 3 cartilages includes the arytenoids, corniculates and cuneiforms.

The epiglottis is leaf like cartilage. It has broad free upper margin. Its lower end attached to angle between 2 laminae of the thyroid cartilage. A median glossoepiglottic fold and 2 lateral glossoepiglottic folds connects the epiglottis to the base of the tongue.

The thyroid cartilage , being the largest laryngeal cartilage , is v shaped cartilage and is made up of 2 quadrilateral laminae. In male, the line of junction formed by 2 laminae called Adams apple. To it's middle , the vocal cords are attached .

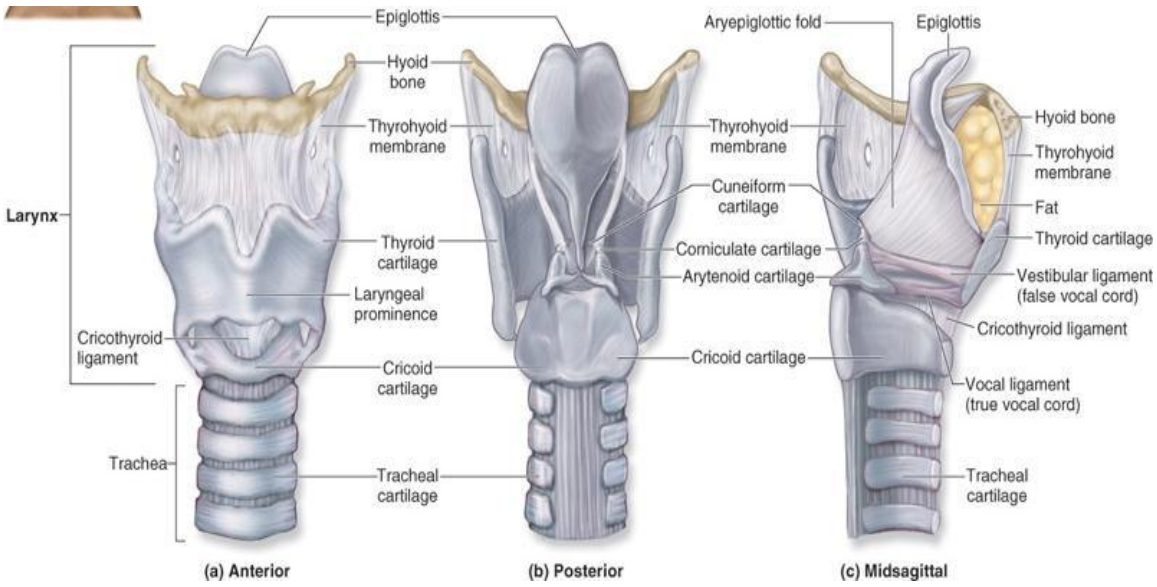


Figure 3: Larynx

The cricoid is the only complete ring cartilage. It resembles signet shaped ring. In the children the cricoid is the narrowest part of the airway. A membrane which extends from cricoid to thyroid in anteriorly is known as the cricothyroid ligament. The free upper border of the membrane of conus elasticus forms the vocal cord.

Arytenoids are pyramidal in shape. The apex of the arytenoids articulates with corniculate and cuneiform cartilage. Vocal cord is attached to the vocal process of the arytenoids cartilage. Corniculates lies at the apex of arytenoids. Cuneiforms are rods shaped and it is situated in front of corniculate.

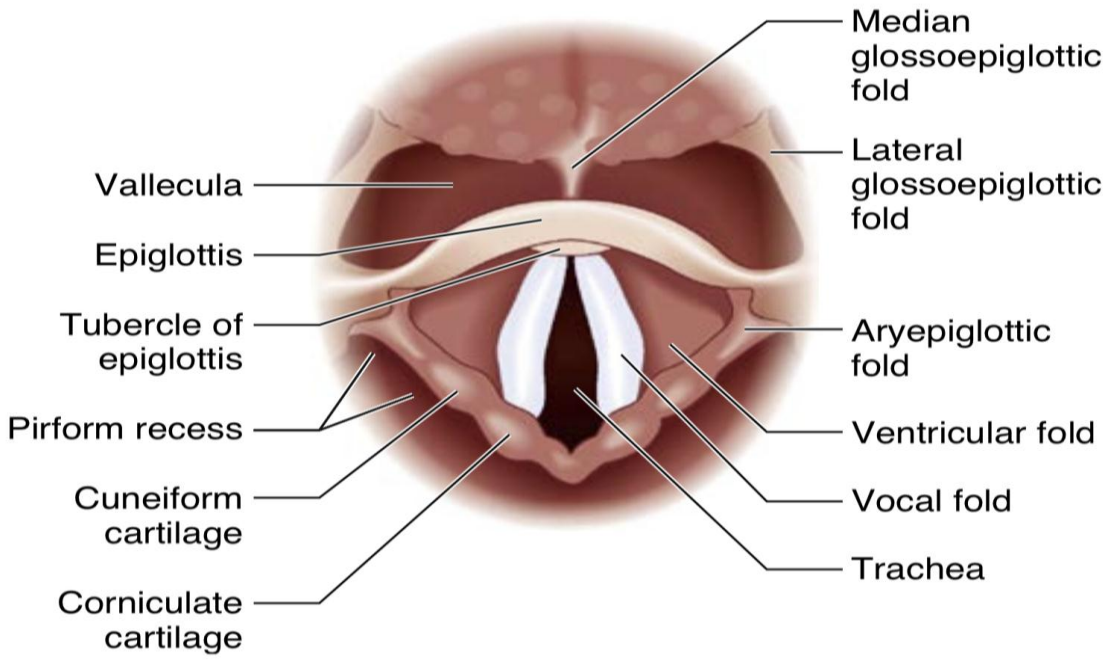


Figure 4: Vocal Cord: (Figure 4)

PHARMACOLOGY OF KETAMINE [31,32,33,47]

History:

Ketamine was first used in humans in 1965 by Corssen and Domino after Stevens created it in 1962. It's clinical use of Ketamine was issued in 1970.

Figure 5 : Ketamine Vial

Chemistry

Ketamine is a phencyclidine consisting of two stereoisomers, S (+) and R (-). The S (+) is more potent and is associated with fewer side effects. in 1970. Chemistry A phencyclidine has two stereoisomers, S (+) and R, is ketamine (-). The S (+) is more potent and has less adverse affects. 238 Kilo Daltons in molecular weight, partly water soluble.

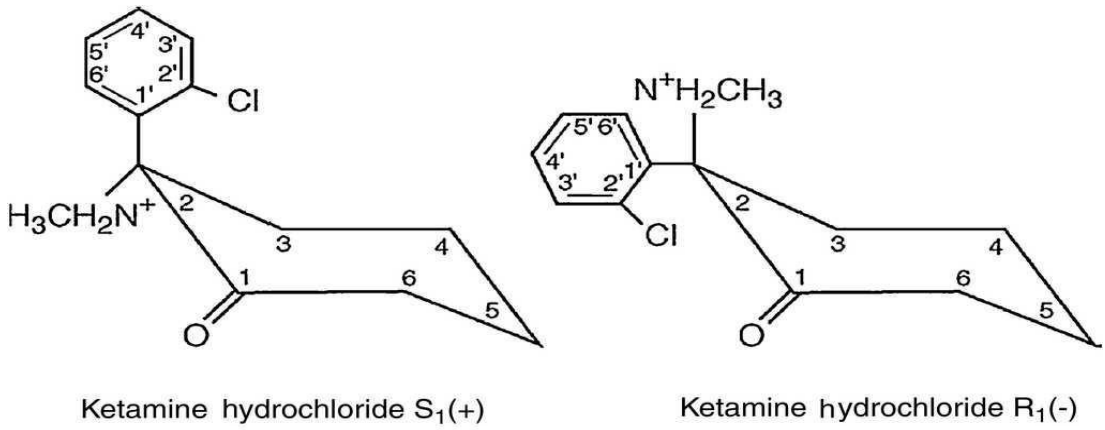


Figure 6 : Stereoisomers

Physicochemical Characteristics

• The pH of a ketamine hydrochloride aqueous solution spans from 3.5 to 5.5.

• Has a pKa of 7.5 and crystallises into a white salt.

• 5–10 times more lipid soluble than thiopental

Metabolism

Hepatic microsomal enzymes break down ketamine. The primary process results in the metabolite norketamine via N-demethylation . This is then hydroxylated to hydroxynorketamine. They are then conjugated to water-soluble derivatives of glucuronide, after which they are removed via urine. The activity of norketamine (metabolite I) is significantly (20–30%) lesser than that of the parent chemical.

PHARMACOKINETICS :

A two-compartment model can be used to understand how ketamine plasma disappears. Half-life of distribution: 11 to 16 minutes Ketamine's high volume of distribution reflects its high lipid solubility. Given the high clearance (890 to 1227 mL/min), the short elimination half-life of 2 to 3 hours can be explained. The average hepatic blood flow (1.4 litres per minute) is roughly equivalent to the mean total body clearance. Different pharmacokinetic properties distinguish the two isomers. In comparison to R (-) ketamine, S (+) ketamine has a higher elimination clearance and distribution volume. The distribution of ketamine clearance is abnormal, and age has no bearing on this. The bioavailability is between 20% and 30% when administered orally, and between 40% and 50% when administered intravenously. IV.

PHARMACODYNAMICS:

- IV: 30- to 60-second window before anaesthesia takes effect Anaesthetic effect's duration: 5 to 10 minutes for IV Maximum impact: one minute Beginning of anaesthesia effect: three to four minutes IM: 12 to 25 minutes long Half-life removal: A: 10 to 15 minutes 2.5 hours for beta Urination is the main excretion. A "dissociative anaesthetic state" is brought on by the CNS effect and refers to the functional and electrophysiological separation of the limbic and thalamoneocortical

systems. characterised by catalepsy, with intact corneal and light responses and open eyes with a sluggish nystagmic stare. causes emerging reactions and psychotomimetic behaviour that might be upsetting. Ages under 16 are linked to a higher incidence of responses. Male greater doses: 2 mg/kg; female larger doses.

- Patients receiving IV fast IV injection who difficulties with personality increases cerebral blood flow, intracranial pressure, and the rate at which the brain uses oxygen metabolically. The emergence of theta-activity and "petit-mal like" seizure activity are indicators of ketamine's excitatory effects. prevents central hypersensitivity to pain. It reduces the effects of acute tolerance to opiates, impedes the medial medullary reticular formation's ability to transmit impulses, which is crucial for the transfer of the from the spinal cord to higher brain centres, nociception includes emotional components. The general anaesthetic effects and some analgesic effects of ketamine may be mediated by NMDA receptor interaction. Ketamine is known to have analgesic effects via inhibiting dorsal horn wide dynamic range neuronal activity. Whenever taken in sub-anaesthetic concentrations, Ketamine causes effective analgesia at plasma levels that are only an eighth of those required for anaesthesia. This could be linked to its capability to inhibit specific spinal cord activity in laminae (opioid k-receptors, laminae II & II) involved in anti-apoptotic pathways in in addition to reducing NMDA receptor-mediated ion currents-mediated necrotic cell death. Cardiovascular system effects increases heart rate, mean arterial blood pressure, pulmonary and central venous pressures, all of which are related to sympathetic stimulation. It also elevates the levels of the hormones adrenaline and noradrenaline in the blood, which causes peripheral vasoconstriction and directly stimulates the heart. reduced baroreceptor function by way of the nucleus tractus solitarius' NMDA receptors. lengthens the relative refractory period to end arrhythmias brought on by adrenaline. elevates pulmonary artery pressure and right heart rate by increasing pulmonary vascular resistance. Effects on respiratory system: With minimal dose anaesthesia , respiratory depression is also minimal. It is a helpful agent for asthmatics as it promotes bronchodilation. Ketamine helps people with reactive airway diseases. Before using it, an anti-sialagogue should be given.

Uses

Table 1: Showing various dosages of ketamine employed

Induction of Anaesthesia	0.5-2.0 mg/kg IV
	4.0-6.0 mg/kg IM
Maintenance of Anaesthesia	0.5-1 mg/kg/hour IV with N2O 50% in O2
+ N2O/O2 or opiates	30-90 µg/kg/min IV without N2O
Sedation and analgesia	0.2-0.8 mg/kg IV
	2.0-4.0 mg/kg IM

• Used in respiratory illnesses, particularly bronchospastic airway disease, hypovolemia, intrinsic myocardial disease, congenital heart disease, cardiac tamponade, and restrictive pericarditis (apart from ischemic heart disease). In healthy individuals with hypovolemia and trauma Anaesthesia • May also be used in concert with N2O and muscle relaxants to provide sleep and analgesia at doses of 15–30 g/kg/min without causing consciousness loss.

• ketamine is seen to increase muscle tone thereby necessitating the need for muscle relaxant administration.

Obstetrics

• used as an induction agent in caesarean section in doses < 1.5 mg/kg IV as higher doses may lead to Useful as an adjunct to epidural and spinal anaesthesia in low "analgesic" dosages (0.2- 0.3 mg/kg). May cause foetal depression . best suited for short surgeriesin children . Can For children, IM doses ranges between 5 to 10 mg/kg, with an onset in 3-5 minutes and lasting of 10 to 30 minutes. Due to the significantly lower prevalence of emerging responses in children, the use is more versatile.

• Reduced dosage are required for diagnostic treatments including radiation therapy, dental work, or heart catheterization. Local and regional anaesthesia adjunct

• Ketamine provides amnesia, drowsiness, and pain relief during the execution of blocks without depressing the heart rate.

• used in adjunction with benzodiazepines for sedation during regional anaesthesia

Antinociception

• Ketamine yeilds its antinociceptive action via inhibition of NMDA receptors and actuates the inhibiting monoaminergic pain pathways that descend. Spinal reflexes that are mediated by NMDA receptors are implicated that contribute to the neuropathic pain.

• Norketamine has antinociceptive effects and improves the antinociceptive effects of opioids against heat nociception, peripheral neuropathy, and tonic inflammatory pain, as well as blocking tolerance. • After heart surgery with cardiopulmonary bypass, low-dose ketamine (0.5 mg/kg) reduces the rise in serum C-reactive protein, IL-6, and IL-10 associated with inflammation.

Burns Patients :

• Higher dosages (4-6 mg/kg IV) are sufficient for eschar excision.

• Used often for dressing changes, debridement, and skin grafting (1.5-2.5 mg/kg IM). Miscellaneous

• Effectively utilised in patients who are susceptible to malignant hyperthermia, myopathies, porphyria, etc. When compared to other induction drugs, ketamine produces a more stable and well-functioning cardiovascular system in acute hypovolemia.

Disadvantages: An elevated intracranial and intraocular pressure, increased muscle tone, spontaneous movements during induction and anaesthesia, stimulation of the cardiovascular system, slow recovery, emergency reactions, postoperative nausea, and vomiting strong sialagogue, particularly in children

Contraindication: uncontrollable hypertension recent myocardial infarction, unstable angina, and either left or right heart failure Heart valve disease, however it may also be helpful for congenital heart disease abdominal, thoracic, or intracranial aneurysms

Conditions that cause elevated intracranial pressure and cerebrovascular disease recently piercing eye injury

LIDOCAINE[21,47,] :

It is a local anaesthetic of amino amide group . Lidocaine is a synthetic aminoethylamide with local anesthetic and antiarrhythmic properties.Introduced in 1948, it is currently the most widely used LA. When injected around a nerve , the block occurs within 3 minutes . Vasodilatation occurs after the block , around the injected area. It is variedly used for local surface application, infiltration, nerve block, spinal , epidural anaesthesia and regional block . Early central effects of lidocaine include drowsiness, mental clouding, altered taste and tinnitus. Overdose can cause muscle twitching, convulsions, cardiac arrhythmias, fall in BP, coma and even respiratory arrest . Lidocaine is also used as a popular antiarrhythmic in practice .

Chemical nature :

Diethylamino acetic acid is the source of this tertiary amide. Lidocaine is a monocarboxylic acid amide formed when 2,6-dimethylaniline and N,N-diethylglycine are formally mixed.

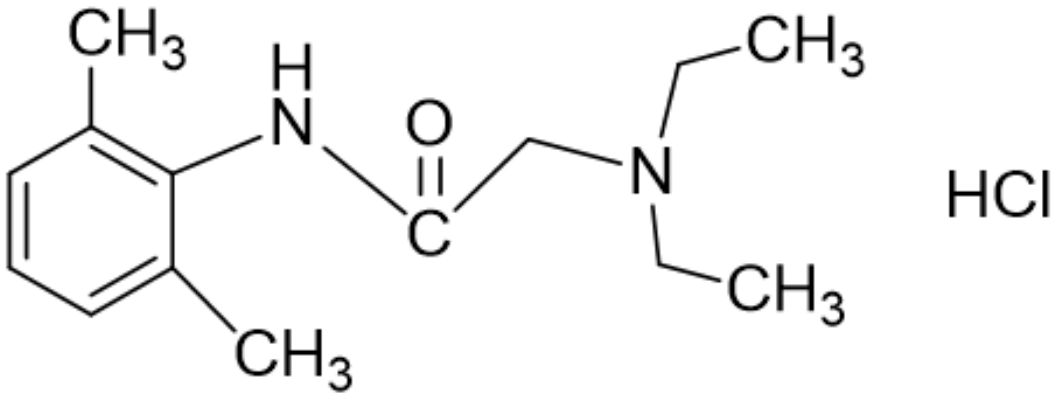


Figure 7 : Lidocaine Structure

Figure 8: lidocaine vial

Physiological action [74]:

The LAs block nerve conduction by decreasing the entry of Na+ ions during upstroke of action potential (AP). As the concentration of the LA is increased, the maximum depolarization of action potential decreases which causes slowing of conduction . Eventually , depolarization fails to reach the threshold potential and hence conduction block occurs .

The LAs interact with a receptor situated within the voltage sensitive Na+ channel and raise the threshold of channel opening: Na+ permeability fails to increase in response to an impulse or stimulus. Impulse conduction is interrupted when the Na+ channels over a critical length of the fibre (2–3 nodes of Ranvier in case of myelinated fibres) are blocked. The equilibrium between the unionized base form (B) and the ionized cationic form (BH+) depends on the pKa of the LA.

The cationic form (active)of LA approaches its receptor only when the channel is open at the inner face and binds more to the inactive state of the channel thereby prolonging the inactive state. The channel takes longer to recover as the refractory period of the fibre is increased. A resting nerve is resistant to blockade. Blockade develops when the nerve is repeatedly stimulated . Higher the frequency of stimulation, greater the blockade. However, exposure to higher concentration of Ca2+ reduces inactivation of Na+ channels and lessens the degree of block. The onset time of blockade is related to the pKa of the LA. LA is present in the undissociated base form at pH of 7.4 and this form penetrates the axon.

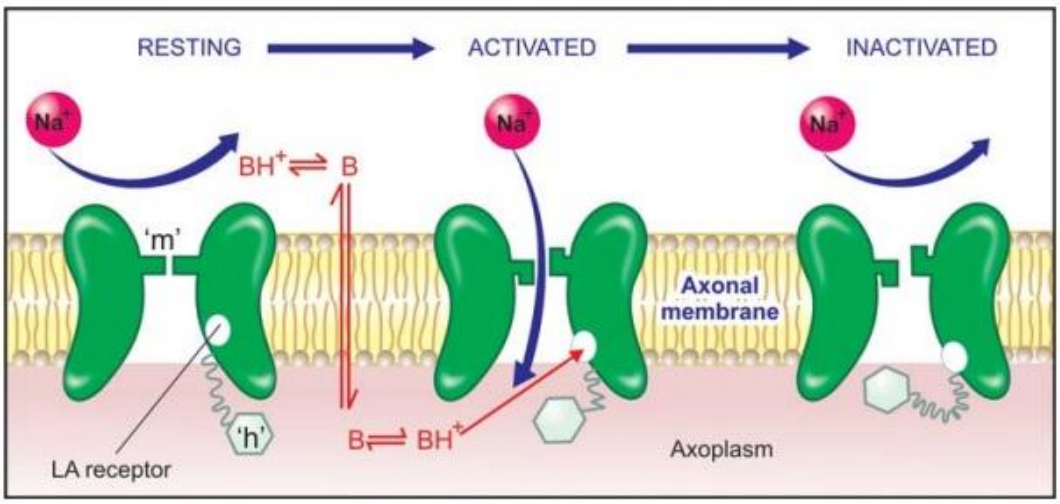


Figure 9: Action of LA

Pharmacokinetics:

(a) Lidocaine is 64–70% protein-bound in the plasma, predomi- nantly to alpha-1 acid glycoprotein; the VD is 0.7–1.5 l/kg.

(b) 70 percent of the dose is metabolized in the liver.

(c) Lidocaine is metabolized in the liver by N-dealkylation, with subsequent hydrolysis to monoethylglycine and xylidide. Monoethylglycine is further hydrolysed, whilst xylidide undergoes hydroxylation to 4-hydroxy- 2,6-xylidine which is the main metabolite and excreted in the urine.

(d) Metabolites of lidocaine may lower the fit threshold, thereby potentiating seizure activity, whilst others have some antiarrhythmic properties.

(e) Less than 10% of the dose is excreted unchanged in the urine. The elimination half-life is 90–110 minutes, and the clearance ranges from 6.8–11.6 ml/min/kg.

(f) The absorption of local anaesthetic agents is related to the site of injection (intercostal > caudal > epidural > brachial plexus >subcutaneous)

(g) The pKa of lidocaine is 7.7 and is 25% unionized at a pH of 7.4. The heptane:buffer partition coefficient is 2.9.

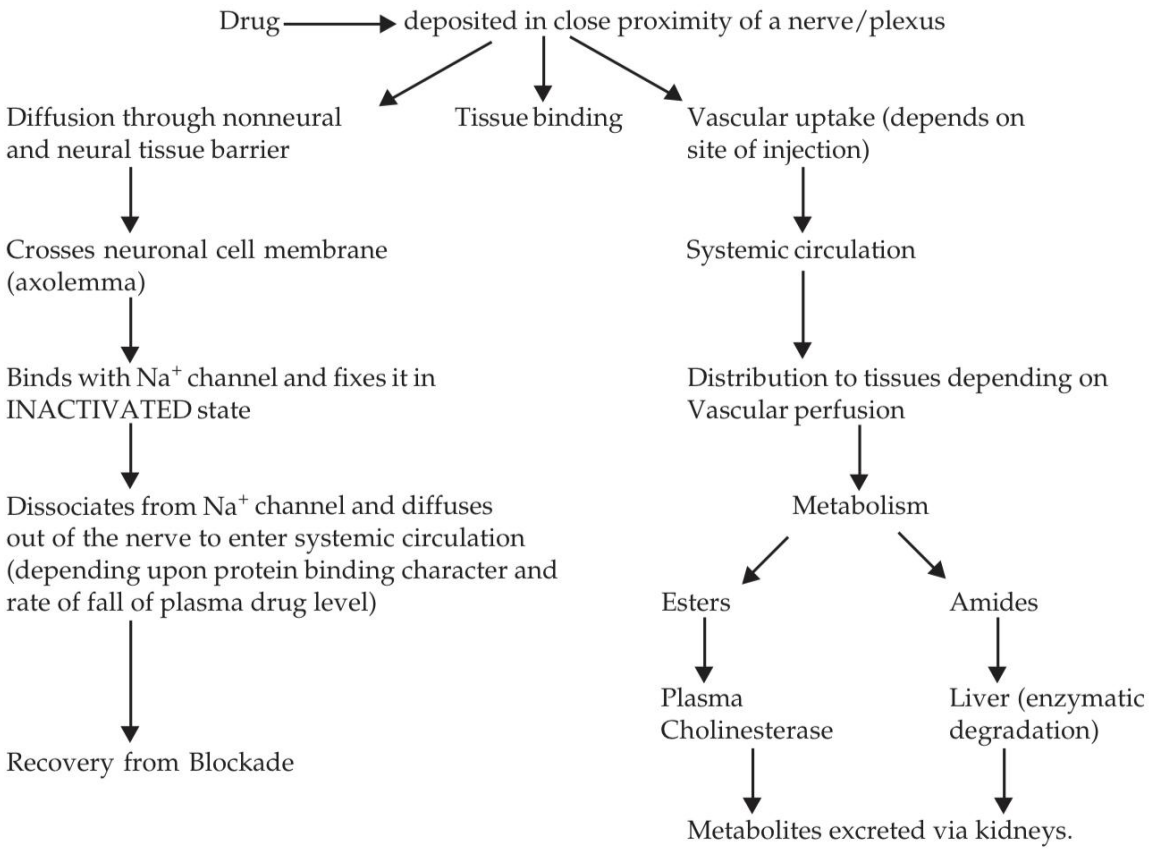

Drug
deposited in close proximity of a nerve/plexus
Diffusion through nonneural and neural tissue barrier
Tissue binding
Vascular uptake (depends on site of injection)
Crosses neuronal cell membrane (axolemma)
Systemic circulation
Binds with Na+ channel and fixes it in INACTIVATED state
Distribution to tissues depending on Vascular perfusion
Dissociates from Na+ channel and diffuses out of the nerve to enter systemic circulation (depending upon protein binding character and rate of fall of plasma drug level)
Metabolism
Esters
Amides
Plasma Cholinesterase
Liver (enzymatic degradation)
Recovery from Blockade
Metabolites excreted via kidneys.

Figure 10 : Fate of Local Anaesthetics

PHARMACODYNAMICS :

Central nervous system :

All LAs primarily function by inhibiting neurons; the first appearance of stimulation is actually caused by the inhibition of inhibitory neurons. At high doses, all neurones are inhibited and flattening of waves in EEG is seen.Lidocaine, however , can initially cause drowsiness and lethargy, but higher doses produce excitation followed by depression like others.

Cardiovascular system:

LAs are cardiac suppressors, but at therapeutic levels, no discernible effects are seen. At high doses or on inadvertent i.v. Injection, they lengthen the effective refractory period and reduce automaticity, excitability, contractility, and conductivity (ERP). They have a quinidine like antiarrhythmic action.Lidocaine has little effect on contractility and conductivity; it abbreviates ERP and is used as an antiarrhythmic

LAs tend to produce fall in BP. Although high doses, as achieved locally at the injection site, do directly relax arteriolar smooth muscle, sympathetic inhibition accounts for the majority of this.

RS:

The drug causes bronchodilatation at subtoxic concentrations. Respiratory depression occurs in the toxic dose range.

AS :

Local anaesthetics depress contraction of the intact bowel.

Metabolic/other :

Lidocaine may have some anticholinergic and antihistaminergic activity.

Onset and duration of action :

Depending on the administration route, the initiation of the effect can take 2 to 20 minutes. Depending on the concentration and the presence of vasoconstrictors, the duration of effect ranges from one to three hours.

USES AND DOSAGES

1. Local Infiltration 5- and 10-mg/mL solutions
2. Peripheral nerveblockade 10-, 15-, and 20-mg/mL solutions
3. Epidural10-, 15-, and 20-mg/mL solutions
4. Spinal 50-mg/mL solution
5. Topical 20-mg/mL jelly, viscous
6. Topical 25- and 50-mg/mL ointment
7. For intravenous route :-1 to 1.5 mg/ kg preservative free solution

AVAILABILITY:

As a clear, colourless solution in concentrations of 0.5/1/1.5/2% solution of lidocaine hydrochloride (with or without 1:200 000 adrenaline); a gel containing of 21.4 mg/ml of lidocaine hydrochloride (with or without chlorhexidine gluconate); a 5% ointment, a 10% spray, and a 4% aqueous solution for topical application; and as a cream/ suppositories (in combination with hydrocortisone) for rectal administration.

The 1% and 2% preparations are available with or without the preseratives methylhydroxybenzoate (1.7 mg/ml) and propylhydroxybenzoate (0.3 mg/ml). In some formulations, sodium hydroxide and hydrochloric acid are also present.

Toxicity/side effects :

Lidocaine is intrinsically less toxic than bupivacaine. The amide-type local anaesthetic drugs very seldom cause allergic responses. As previously mentioned, the negative effects are primarily associated with high plasma drug concentrations.

Toxic dose:

> 3 mg/kg without adrenaline

> 7 mg/kg with adrenaline

NEBULIZER :

A nebulizer (aerosol generator, atomizer, nebulizing humidifier) emits water in the form of an aerosol mist (water vapor plus particulate water) (166). The pneumatically powered (gas-driven, jet, high pressure, compressed gas) and ultrasonic nebulizers are the two that are most frequently used. Both are heat-able. Nebulizers can be used to administer medications to the respiratory system in addition to humidification.

By propelling a jet of high-pressure gas into a liquid, a pneumatic nebulizer creates shearing forces that break the water down into tiny particles. By putting liquid through a high-frequency, electrically powered ultrasonic resonator, an ultrasonic nebulizer produces a fine mist. The size of the droplets is dependent on the oscillation frequency. There is no need for a driving gas. Pneumatic nebulizers produce a thinner mist than ultrasonic ones do.

Use

Pneumatic nebulizers require a strong gas flow, hence they should be connected to the fresh gas line. An ultrasonic nebulizer can be used in the fresh gas line or the inspiratory limb.

Advantages

Nebulizers can produce gases carrying additional water if needed and can distribute gases that are already saturated with water without the need for heat.

Disadvantages

Nebulizers are somewhat costly. Pneumatic nebulizers require high gas flows. Ultrasonic nebulizers require a source of electricity and may present electrical hazards. There may be considerable water deposition in the tubings, requiring frequent draining, water traps in both the inspiratory and exhalation tubes, and posing the dangers of water draining into the patient or blocking the tubing.

Ultraspnic produces fine particles . Produces finer particles and to micro particles get absorbed immediately after nebulisation finishes . Especially in paediatric age group.

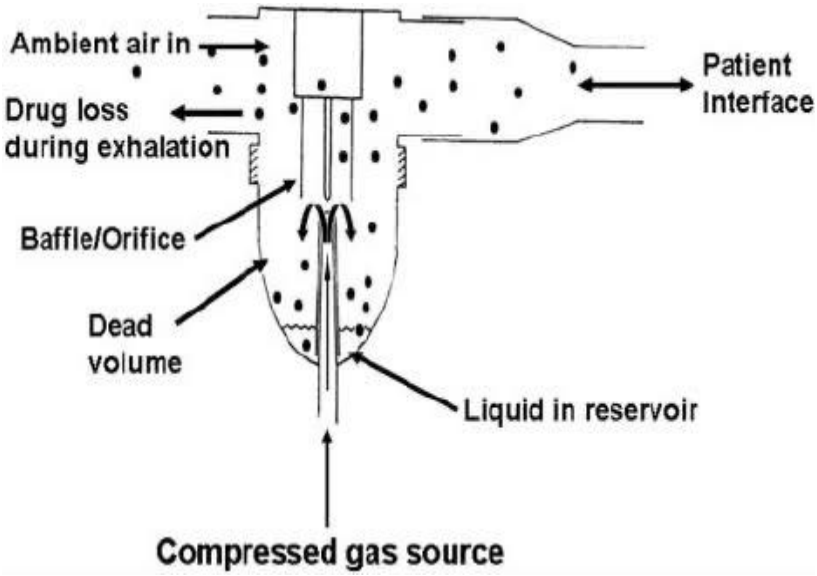


Figure 11: Principle of Pneumatic Nebuliser .

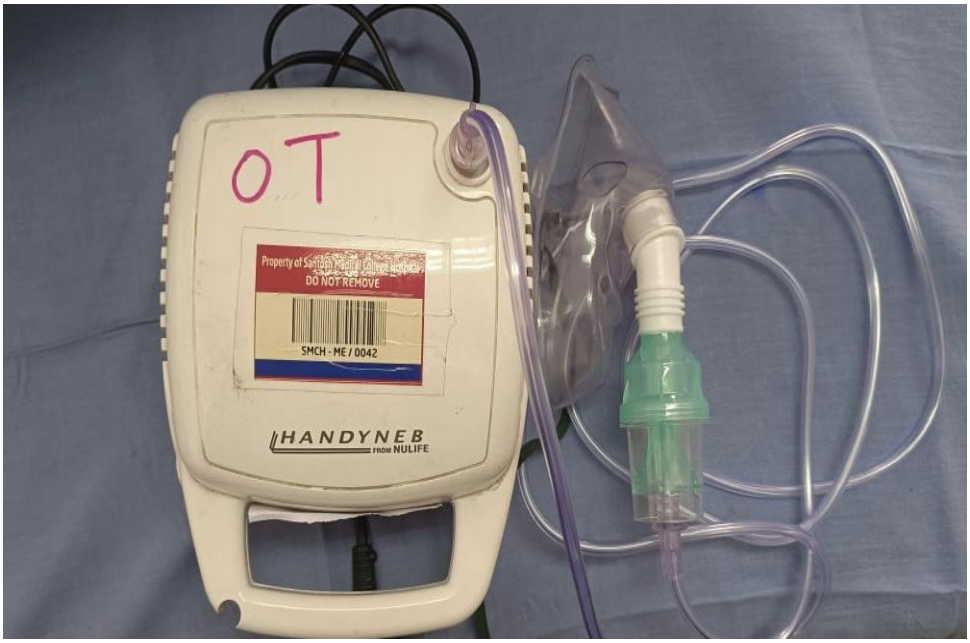


Figure 12 : Nebuliser used for the Study .

REVIEW OF CLINICAL STUDIES

The earliest descriptions of tracheostomy date back to around 2000 BC and 1500 BC[22]. Ancient tracheotomies were the sole means of airway access and management for a long time . Since then the airway management has come a long way.

Hippocrates described tracheal intubation for humans to support ventilation around 380 BC [23].

Benjamin Pugh in 1754 created an air pipe which was introduced in a neonate and blow breaths were given to facilitate ventilation.[68]

It wasn't until the 1870s when Trendelenburg from Germany performed the first endotracheal anesthesia in man[22] and MacEwan performed the first orotracheal intubation in 1880 [71].

In the 20th century , Franz Kuhn created a malleable endotracheal tube from a wire spiral with a rubber insertion[66].

Rubber was replaced with plastic for tube material in the 1960s and the modern cuffed endotracheal tube came into light[22]. Endotracheal anaesthesia is one of the most applied anaesthetic techniques for airway management today and has its own set of advantages and disadvantages[71].

Despite rapid advancement in anaesthetic techniques for airway management , these complaints are some of the many concerns for anaesthesiologists in today's practice [51]. An attempt is made during the procedure to cause minimal post operative side effects to the patient . However , The incidence of post operative sore throat is about 21-65% [50]and it's occurrence varies with the type, diameter, and cuff pressure of the endotracheal tube being used[61].

The aetiology for occurrence of postoperative sore throat is multifactorial, including factors specific to the patient, such as age, gender, and smoking; intubation factors, such as technique, length, tube size, intracuff pressure, cuff design, intraoperative tube movement, and suctioning. Many other factors including the technique and expertise of the person performing the intubation also affects the extent of post extubation effects . Postoperative pain, including sore throat also increases the need for

analgesia .[62] When intubation is essential, it may be helpful to give drugs prophylactically to alleviate postoperative sore throat[13] . Sore throat, hoarseness[62] and cough , besides pain and nausea or vomitting rank among the most frequent subjective complaints after endotracheal intubation for airway management under general anaesthesia[52].

Studies have been done on a variety of pharmacological and non-pharmacological interventions to lessen the frequency and intensity of post-extubation sore throats. Some of the techniques used to lessen postoperative sore throat include using smaller tubes[82], high volume low pressure endotracheal tubes[5] , meticulous instrument manipulation of the airway, appropriate intracuff pressure, completely deflating the cuff prior to actually extubation[73], greasing with lignocaine jelly, betamethasone gel[73], IV dexamethasone[70], beclomethasone inhalation[67], lozenges, as well as aspirin gargle[25].

POST includes complaints of laryngitis, tracheitis, hoarseness, cough or dysphagia[61]. POST is caused by injury to the pharyngeal mucosa during laryngoscopy, resulting in an aseptic inflammatory process or irritation to the tracheal mucosa produced by endotracheal tube cuff or it can also be due to injury to tissues during intubation and extubation[15] .Most of the times , the cuff of the endotracheal tubes once inflated blocks the lymphatic drainage and causes local mucosal edema . Mechanical compression from high intracuff pressure may lead to tracheal mucosal hypoperfusion, ischaemia, ulceration, and even pain[30,31].

POST may also be caused by circumstances such as low airway humidity, injury from airway insertion, suctioning, elevated anaesthetic air flow rates, and surgical handling of the airway and surrounding tissue[45]. Most common, laryngeal trauma[37] with mucosal dehydration is seen to occur due to forces generated by the inflexible tubes, posteriorly across the cricoid plate as well as over the arytenoids' vocal processes. Trauma to the trachea's cartilaginous rings often exclusively affects the anterior tracheal wall and is thought to be caused by manipulating the tube[28]. Even after uneventful intubation, pathological alterations in the laryngotracheal area, like epithelium loss, glottic hematoma, glottic edoema, sub mucosal tears, and contact ulcer granuloma, might develop as a cause of the postoperative hoarseness[67].

As the age progresses , there is reduced tissue flexibility around the trachea, which could increase the risk of injury during laryngoscopy and intubation. When the conventional polyvinylchloride tube is employed, such lesions are more frequently found in the interarytenoid and subglottic region. This is most likely caused by the polyvinyl chloride tube's elastic recoil, which increased pressure on the larynx's posterior wall[28]. The posterior larynx, particularly the cricoid and arytenoid, serves as a fulcrum [39,40]and the normal endotracheal tube as a curved lever. Even if they do not result in overt hoarseness, almost all tracheal intubations are connected to laryngeal alterations that impact the voice-frequency histogram[41,43,45].

Nebulization therapy is widely used to prevent POST. It is a highly recommended therapy as small volume of drugs is required for desirous effect , greater patient compliance, an uncomplicated method of administration, and, most significantly, negligible chance of any adverse events as compared to other methods(such as gargle, intravenous, etc.)[9]. Commonly used aerosolized drugs have included corticosteroids, ketamine, magnesium, lidocaine, Non-steroidal anti-inflammatory drugs(NSAIDs) to achieve desired effects[20,10,11,12]. Despite the continuing clinical trials on POST nebulization therapy, there is still no authentic data available for all the relevant drugs. There is a lack of direct comparisons between frequently used aerosolized drugs and a lack of clinically useful ranking of all nebulising drugs in the respect to both efficacy as well as acceptability.

Ketamine is a synergetic N-methyl-D-aspartate/glutamate receptor antagonist[60] which is known to decrease pain by shrinking central sensitization, hyperalgesia, and “wind-up” phenomenon at the spinal cord level and CNS [24] . N-methyl-D-aspartate (NMDA) receptors are ligand-gated non-selective ionotropic glutamate receptors (iGluRs). These receptors are found to be in maximum density within the hippocampus and the cerebral cortex[25] . However they are present in the post-synaptic membrane of neurons throughout the body [25].

Nebulisation with analgesics provides rapid, effective, and titratable analgesic delivery of drugs . It is a non invasive and less painful method of analgesic delivery and helps minimize analgesic toxicity and side effects[27] .

Nebulized administration of ketamine has been studied variedly in the areas of palliative care, therapy for asthma, and acute postoperative management of sore throat [20,70,17,28,29]. Various clinical trials have compared nebulized ketamine either in a fixed-dosing regimen (50 mg) or weight-based dosing (0.5 mg/kg, 1mg/kg, or 1.5 mg/kg) to placebo in reducing post intubational sore throat. Ketamine has been found to work on the NMDA receptors present in the peripheral nerve endings in the pharyngeal mucosa which in turn helps decrease the incidence of sore throat.. The average decrease of postoperative throat pain has been seen to be by 44–50% , without any major side effects. . Similar to here, inhaling ketamine did not cause any adverse effects in healthy volunteers, including oropharyngeal irritation, excessive salivation, stridor, laryngospasm, cough, dry mouth, breathing difficulty , aspiration or dysrhythmias[53,54] .

Lignocaine nebulization has also been studied with differing outcomes . Cullen et al[56] found that lignocaine nebulization was seen to decrease the discomfort of nasogastric tube insertion. Similarly, lignocaine nebulization added to topical nasal lignocaine produced adequate upper airway anesthesia for fiberoptic nasotracheal techniques[56] .

Nebulization with lignocaine results in good distribution of the drug on the surface of the upper airway and tracheobronchial tree leading to airway analgesia and suppression of the cough reflex[57]. This method of drug delivery also reduces the possibility of accidently injecting medication into blood vessels[58]. The antinociceptive effects of lignocaine are due to stoppage of the sodium entering the nerve ending at the site of the pain. This prevents an electrical signal from building up and passing along the nerve fibres to the brain. It works by temporarily blocking this pathway of pain signals along the nerves.[59]

The effectiveness of intra-cuff lidocaine in reducing post-operative sore throat was investigated in a study by Navarro RM et al(1997)[34]. In 53 of the 106 patients examined, the cuff was inflated with air; the remaining 53 received an intracuff injection of 2% lidocaine solution. It was shown that using lidocaine to fill the cuff instead of air reduced the intensity and frequency of POST.

After extubation, sore throat, hoarseness, and cough were examined by Ayoub CM[43] et al in 1998. Endotracheal tubes were evenly lubricated from the cuff to the 15-cm mark using 3 mL of a water-soluble gel that contained either betamethasone 0.05% alone or in combination with chlorhexidine gluconate (equivalent to 3 mg of prednisone). It was determined that steroids injected to the cuff significantly reduced post-operative sore throat..

Canbay O14 (2008)[44] looked into the effects of ketamine gargle on postoperative sore throat. 56 patients were examined assigned into two groups . Five minutes prior to induction, one group gargled with normal saline, while the other took 40mg of ketamine diluted in normal saline. In the group that received regular saline gargles, sore throat incidence and severity were higher. Thus, this study came to the conclusion that ketamine gargle was useful in lowering both the incidence of postoperative sore throat.

In order to prevent POST, Honarmand A et al[20] (2008) assessed the effectiveness of Beclomethasone inhalation against intravenous lidocaine. Researchers compared 50 mcg of beclomethasone inhalation, 1 mg/kg and 1.5 mg/kg of lignocaine delivered intravenously, with normal saline. In terms of relieving post-operative cough and sore throat, it was established that beclomethasone inhalation is comparable to intravenous lidocaine given prior to intubation. Additionally, postoperative sputum production is less common and less significant while using a beclomethasone inhaler.

In a 2009 trial, Rudra A et al.[35] sought to determine whether gargling with ketamine decreased postoperative sore throat brought on by endotracheal intubation. Both the control and study groups received normal saline and 50mg of ketamine as a gargle solution, respectively. Following surgery, both groups were monitored for a full 24 hours. Without causing any medication-related side effects, ketamine significantly decreased both the frequency and intensity of post-operative sore throat.

The prophylactic use of ketamine gargle to alleviate POST following endotracheal intubation was researched by Rajkumar G et al[7] (2012). 90 patients having ASA status I and II between 18 to 65 years of age were enrolled in the study. pre operatively , Group S received 30 ml of normal saline and Group K received 40 mg

of ketamine in 30 ml of normal saline. The patients were monitored for an entire day . The group that received ketamine saw a considerably lower incidence of hoarseness.

Betamethasone gel used over the endotracheal tube and ketamine gargle were compared in a study by Shaaban AR et al[3](2012) to assess which was more effective for reducing POST, coughing, and hoarseness of voice. One group of patients were asked to gargle with a mixture of ketamine 40 mg in 30 ml saline for 60 seconds. In another group of patients, tracheal tubes were lubricated with 2.5 ml of betamethasone gel 0.05% from the distal end of the cuff and the control group did not receive either of the above. The incidence and severity of sore throat was significantly higher in the control group at all time points in comparison with the other two groups. Hence it was concluded that gargling with ketamine prior to intubation is comparable with betamethasone gel when applied over the endotracheal tube in reducing postoperative sore throat. In addition, it was seen that compared to ketamine gargles, betamethasone gel reduced the frequency and intensity of postoperative cough and hoarseness of voice. compared to ketamine gargles.

Sharma R et al (2015)[36] , conducted a randomized control trial to assess the efficacy of ketamine gargles in attenuating post operative sore throat. Occurrence of sore throat was found to be significantly less in ketamine group at four hours post extubation. Though not significant, occurrence was lower in ketamine group at all other times . The severity of sore throat was significantly less in ketamine group at four hours post extubation . No local or systemic side effects were observed.

Ketamine that was used earlier as gargle for reducing POST was found to have its own set of limitations. Hence ketamine used as a nebulisation agent was studied eventually for benefits and disadvantages .

Vaghela AP et al (2019)[9] , compared the the prevalence of post-operative sore throat in patients undergoing general anaesthesia following nebulization with ketamine and lidocaine.. They held a study among fifty patients of ASA grading I and II, aged between 15-65 years and randomly divided them into two groups of 25 each. Each group received ketamine and lignocaine nebulisation respectively and all of them were assessed for post operative sore throat post extubation . It was concluded that preoperative nebulization is a simple, safe and effective technique to reduce incidence

of post-operative sore throat, hoarseness of voice and cough. There was a decrease in the frequency of ST in ketamine group as compared to the lignocaine group.

Another study was done by Rao, et al(2015)[18] on Lignocaine Nebulization to see prevention of POST. This study was done to compare the effect of lignocaine for the Treatment of Post-Operative Sore Throat. The study establishes the effectiveness of lignocaine nebulization for the treatment of POST resulting from endotracheal intubation. Improvement in the severity of POST was observed after the lignocaine nebulization as compared with the control group that recorded nebulisation with normal saline.Therapeutic lignocaine nebulization was well tolerated by the patients and provided immediate relief, except for transient numbness of oropharynx and bitter taste in the mouth.

Y Tanaka et al[13] , in a study conducted on 2009 , revised in 2015 , assessed the use of topical as well as systemic application of lidocaine in prevention of POST and the results were positive however varied depending on the concentration of the drug used in comparison to the control group where only normal saline was used .This review established the effectiveness of topical and systemic lidocaine for the prevention of postoperative sore throat resulting from intubation. The effect size of lidocaine was seen to be affected by drug concentration and route of administration; management of cuff pressure during anaesthesia; the included population; and the type of outcome measured.

Another study done by Klemola *et al,*[16] established the effectiveness of lignocaine for prevention of POST by comparing the use of lignocaine jelly with lignocaine spray in the e group vs control group which did not receive lignocaine . The effects of lignocaine spray and lignocaine jelly as lubricants were studied for incidence of sore throat, hoarseness, and tracheal irritability . About 62% patients were found to be with side-effects in the control group and 95% after receiving the combination of lignocaine jelly and spray ($P < 0.05$). The side-effects after lignocaine jelly alone were 85% and after the spray alone about 68%. It was eventually concluded that lignocaine jelly with the use of a spray significantly increased post-operative side-effects.

Derlin Thomas *et al* (2018) , evaluated the effectiveness of nebulised ketamine in allievating POST following general anaesthesia with tracheal intubation ina

randomised controlled clinical trial among 96 patients[14]. There was statistically significant reduction in the incidence of POST in ketamine group when compared to that of saline, at 2, 4, 6,12, and 24 hours postoperatively. Conclusively , preoperative administration of nebulized ketamine effectively reduced the incidence and severity of POST in patients undergoing GA with endotracheal intubation, with no adverse effects.

In a study of 100 patients by Ahuja *et al*,(2015)[20] it was observed that the incidence of POST in ketamine group was statistically significant only at 2 h and 4 h postoperatively . POST was observed in 23 patients (46%) in the saline group and 10 patients (20%) in the ketamine group, representing a 33% overall frequency. In conclusion , ketamine nebulization when given preoperatively lessened the incidence and severity of POST, particularly during the initial hours of postoperative period with no adverse effects.

Reddy M et al (2017)[38] , conducted a study in 90 patients to assess the dose dependent effectiveness of ketamine nebulisation in preventing post-operative sore throat due to tracheal intubation. Nebulized, preservative-free ketamine was administered to Group A at 0.5 mg/kg, Group B at 1 mg/kg, and Group C at 1.5 mg/kg body weight for 15 minutes before to intubation. It was observed that Nebulized ketamine at a dose of 0.5mg/kg was comparatively less effective than 1 mg/kg and 1.5 mg/kg and the difference was statistically significant. 1mg/kg and 1.5mg/kg of nebulized ketamine were better and reduces post-operative sore throat frequency and severity equally well.

Charan Set al(2018)[17] studied to compare the efficacy of inhalation of different doses of ketamine for prevention of post operative sore throat. A prospective, randomized, and double-blind controlled trial Was conducted where 100 patients divided in two groups(50 patients each group) received nebulisation with 25 mg and 50 mg ketamine respectively . It was then concluded that irrespective of the doses (both 25 mg and 50 mg) ketamine was equally effective in both the dose for prevention of the post operative sore throat .

Sivakumar Segaran et al (2018)[29] compared nebulisation with Ketamine versus Magnesium Sulfate for the incidence of post operative sore throat . 80 patients were divided into two groups equally and received magnesium sulfate 250 mg in 5 ml

saline in Group A and ketamine 50 mg in 5 ml saline nebulization in Group B pre operatively . The incidence and severity of sore throat were observed to be significantly decreased in ketamine group at 4 and 6 hours when compared to magnesium sulfate group . It was concluded that nebulisation with ketamine(50 mg) significantly decreased the incidence of POST as compared to that with magnesium sulfate (250 mg).

Yu, et al. in a review and meta-analysis of 32 randomized clinical trials[39], the efficacy of different available nebulized agents was compared for the management of post operative pharyngeal discomfort . The results showed the incidence of post operative pharyngeal discomfort at 1 hour and 24 hours after the surgical procedure and the severity of POST . From the data it was obtained that, with the exception of nebulized lidocaine, nebulized corticosteroids, ketamine, magnesium and benzamine hydrochloride are effective in minimising the discomfort 24 hours after surgery compared to non-analgesics and additionally, the first three drugs showed pronounced effects . The authors then concluded that the prophylactic use of nebulized drugs such as corticosteroids, magnesium and ketamine are effective in preventing the post operative pharyngeal discomfort.

Patodi V et al (2022)[42] compared the effect of preoperative ketamine nebulisation on attenuation of incidence and severity of postoperative sore throat, hoarseness of voice and cough. A prospective, randomised, double blind study was conducted amongst 100 patients belonging to ASA grade 1 and 2 . Two groups of 50 each , each group received ketamine (50 mg) with 4 mL normal saline (NS) nebulisation and with 5 mL NS, respectively, 15 minutes prior to endotracheal intubation. The incidence and severity of POST, hoarseness of voice and cough were assessed post operative for the next 24 hours. Haemodynamic parameters were noted before and after nebulisation, and just after intubation as well. It was concluded that preoperative ketamine nebulisation was found to be more effective in decreasing the the occurrence of ST, hoarsenes and postoperative cough after general anaesthesia with endotracheal intubation along with no or minimal haemodynamic changes and side-effects

Ranjana et al , (2020) [40] following nebulization with ketamine, lignocaine, and magnesium sulphate, the incidence of postoperative sore throat was compared to a control group. a controlled trial with randomization among 120 patients with 30

patients in each group was conducted which suggested that preoperative nebulization with three medications—ketamine, magnesium sulphate, and lignocaine—reduces the chances of sore throat (ST) in those requiring tracheal intubations under general anaesthesia (GA). However, ketamine exhibited the greatest reduction in POST, followed by magnesium sulphate and then lignocaine.

Kamel AAF et al(2020)[46] compared the Effect of preoperative nebulized magnesium sulfate versus lidocaine for the prevention of post operative sore throat . A prospective double blind randomized controlled study was held among seventy-eight patients divided randomly into three equal groups: Group (M) (n = 26): received nebulized magnesium sulfate 250 mg (2.5 ml), Group (L) (n = 26): received nebulized lidocaine 2% 100 mg (5 ml) and Group (C) (n = 26): received nebulized normal saline 5 ml, 15 min prior to the induction of anesthesia. It was then observed that at at 0 and 2 h postoperative, the severity and incidence of sore throat were statistically significantly lower in group M and L as compared to the C group ($P < 0.001$). It was then concluded that preoperative nebulized magnesium sulfate has more protection against post-intubation sore throat than 100 mg nebulized lidocaine lasting for up to 24 h after the operation.

According to a study conducted from july 21 to September 21 , (2022) , Comparison of Preoperative Nebulization with 4% Lignocaine and Ketamine in Reduction of Incidence of Postoperative Sore Throat was done to assess the outcomes . The results suggested that Ketamine nebulization provides better prophylaxis against the occurrence of moderate-to-severe POST as compared to lignocaine.

Ramadevi P *et al(2019),*[26] conducted a prospective randomised control trial where 90 patients were randomised into three groups of 30 each receiving ketamine nebulisation , lignocaine nebulisation and control group receiving normal saline nebulisation each . As a result , it was observed that Ketamine nebulization and lignocaine nebulization provided less discomfort to the patient and the severity of sore throat was progressively less over 24 hrs in the post operative period. To conclude ketamine nebulization provided better relief of post operative sore throat as compared to lignocaine nebulization and no nebulization.

RESULTS

Present study was conducted to compare the nebulisation with Ketamine versus Lignocaine for the prevention of postoperative sore throat in surgeries performed under general anaesthesia planned for endotracheal intubation.

Eighty patients were enrolled for the study who were eligible according to our inclusion and exclusion criteria. These eighty patients were randomly and equally divided into two groups of forty each .

Demographic data

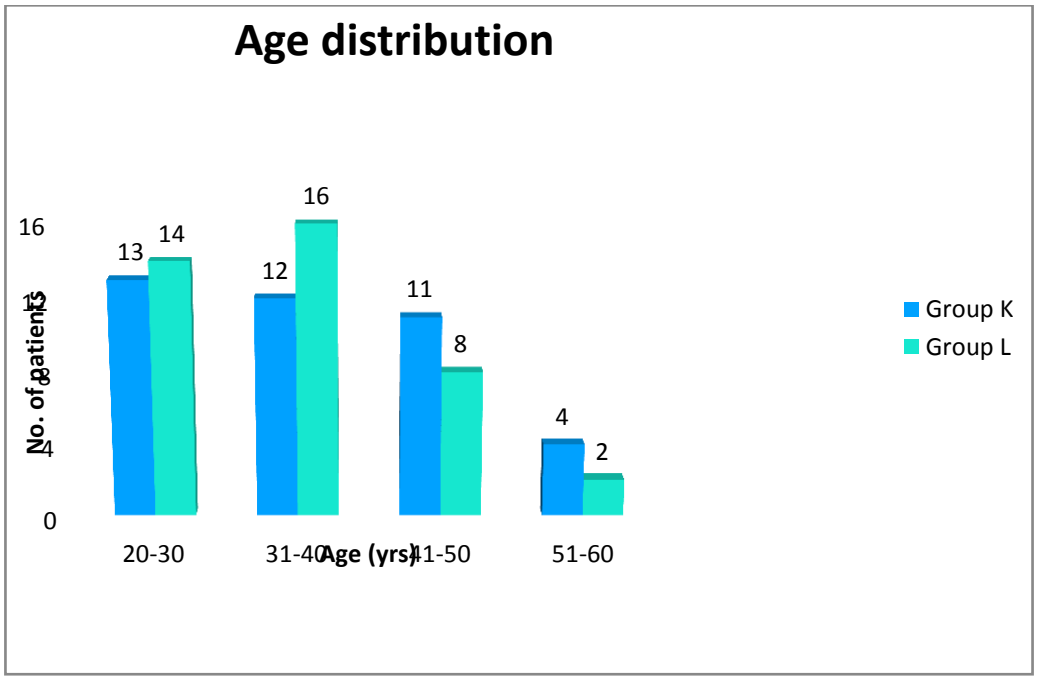
Forty patients were included in the Ketamine group(Group K) and 40 patients were included in the Lignocaine group(Group L).

Age distribution:

TABLE 1: Age distribution

Age (yrs)	Group K		Group L	
	N	%	N	%
20-30	13	32.50	14	35.00
31-40	12	30.00	16	40.00
41-50	11	27.50	8	20.00
51-60	4	10.00	2	5.00
Total	40	100.00	40	100.00
Median	36.5		35	
Range	20-56		23-60	
Mean±SD	36.9±9.9		35.7±8.6	
t & p value	0.613, 0.541			

Unpaired t test



Graph 1: Age distribution

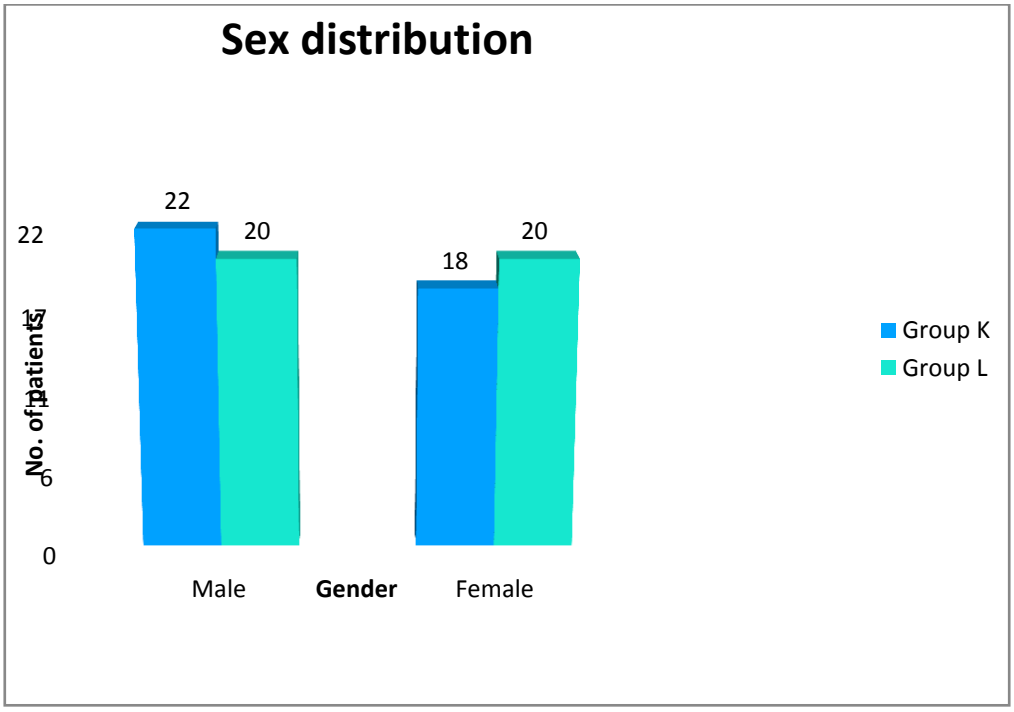
Table 1 demonstrates the age distribution and that unpaired t test is used to analyse the data. The mean age of patients in Group K was 36.9 +_ 9.9 and the mean age in Group L was 35.7+-8.6. The two groups were comparable with respect to age as the difference was not statistically significant as p value is 0.541and t value is 0.613. The majority of our patients were in between 20 – 40 years of age.

Sex Distribution:

TABLE 2: Sex distribution

Gender	Group K		Group L	
	N	%	N	%
Male	22	55.00	20	50.00
Female	18	45.00	20	50.00
Total	40	100.00	40	100.00

Chi square 0.200, P value 0.654 (NS)



Graph 2: Sex distribution

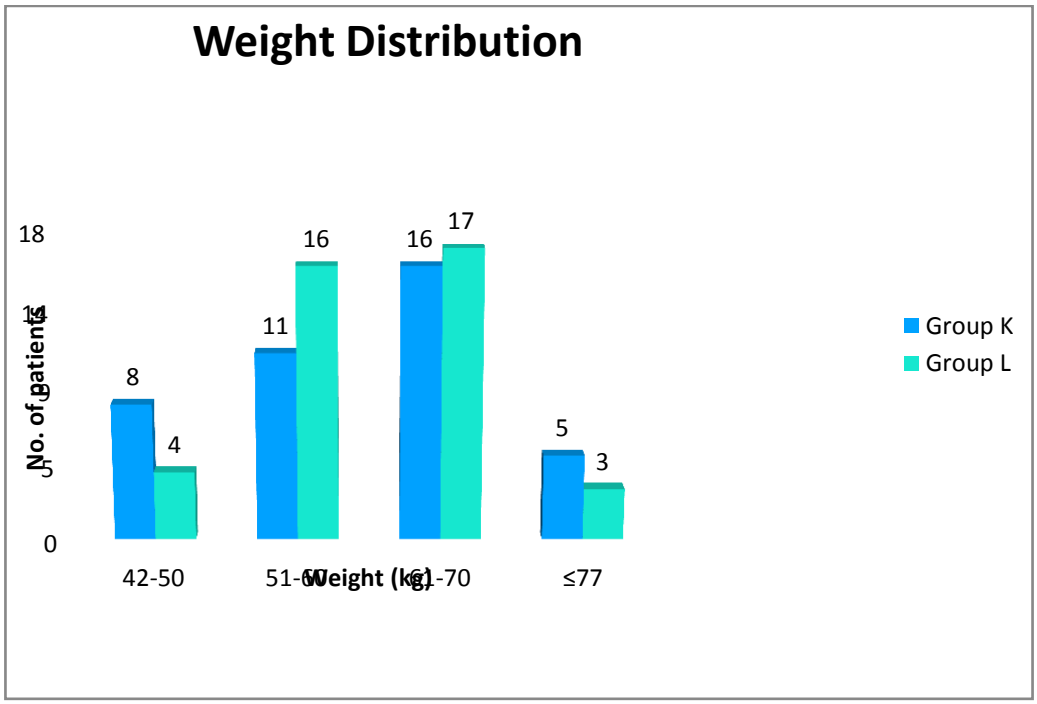
Table 2 shows the distribution according to sex and chi square test for analysis. Out of the total 40 patients in Group K, 22(55%) were males & 18(45%) were females and out Twenty (50%) of the 40 patients in Group L were male, and twenty (20%) were female. The difference between the two groups was examined, however it was not determined to be statistically significant (p=0.654).

Weight Distribution:

TABLE 3: Weight Distribution

Weight (kg)	Group K		Group L	
	N	%	N	%
42-50	8	20.00	4	10.00
51-60	11	27.50	16	40.00
61-70	16	40.00	17	42.50
≤77	5	12.50	3	7.50
Total	40	100.00	40	100.00
Median	61.5		60	
Range	42-77		45-74	
Mean±SD	59.8±9.1		59.9±7.4	
t & p value	0.053, 0.957			

Unpaired t test



Graph 3: Weight Distribution

Table 3 demonstrates the distribution according to weight and unpaired t test is used for analysis. The mean weight in Group K was 59.8±9.1 and mean weight in Group L

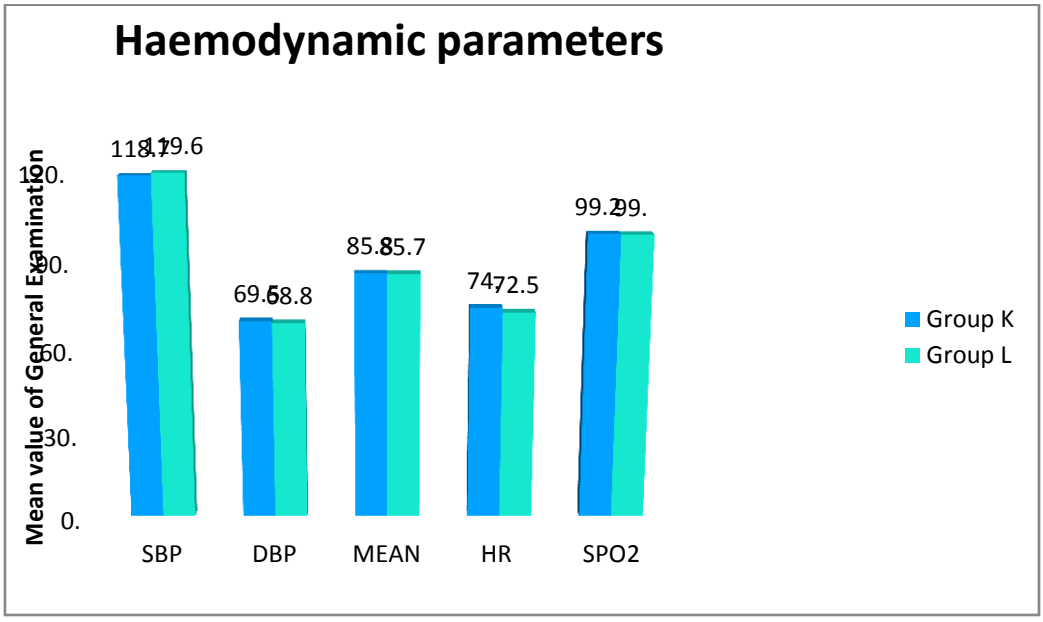
was 59.9±7.4. There was no statistically significant difference between the two groups as p value is 0.957 and t value is 0.053.

Baseline Haemodynamic parameters:

TABLE 4: Baseline Haemodynamic parameters (prior to nebulisation)

General Examination	Group K & L		t value	p value
	Group K (Mean±SD)	Group L (Mean±SD)		
SBP	118.68±8.4	119.63±7.84	0.522	0.602
DBP	69.45±6.76	68.75±6.89	0.458	0.647
MEAN	85.83±5.7	85.70±6.76	0.089	0.929
HR	74±8.8	72.5±8.0	0.79	0.431
SPO2	99.2±0.93	99.0±0.88	0.611	0.542

Unpaired t test



Graph 4: Baseline Haemodynamic parameters

Table 4 demonstrates the hemodynamic parameters and unpaired t test is used for analysis. The mean blood pressure in Group K and Group L was 85.83±5.7 and 85.70±6.76 respectively. The difference in both the groups was not statistically different , p value is 0.929 and t value is 0.089. Mean heart rate in group K is 74±8.8

and in group L is 72.5±8.0. The difference in both the groups was found to be statistically non-significant as p value is 0.431 and t value is 0.79. Similarly for spo2, the data is not statistically significant as p value is 0.542 and t value is 0.611

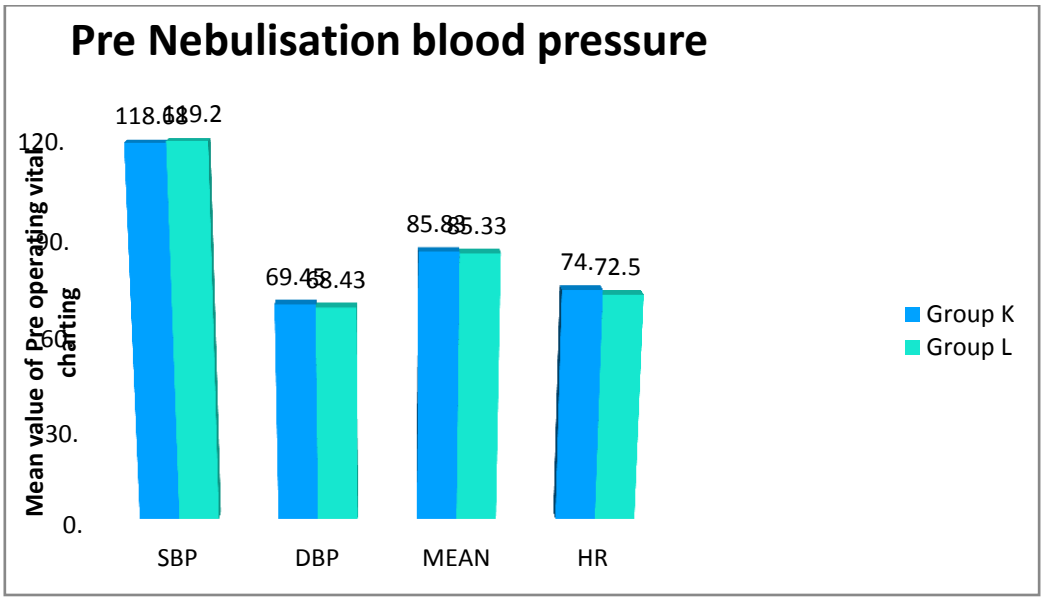
Effect of Nebulisation on blood pressure:

Pre Nebulisation

TABLE 5: Pre Nebulisation blood pressure

Variables	Pre Nebulisation		t value	p value
	Group K (Mean±SD)	Group L (Mean±SD)		
SBP	118.68±8.4	119.2±7.89	0.288	0.774
DBP	69.45±6.76	68.43±6.5	0.691	0.491
MEAN	85.83±5.7	85.33±6.47	0.366	0.714
HR	74.00±8.8	72.5±8.0	0.790	0.431

Unpaired t test



Graph 5 : Pre Nebulisation blood pressure

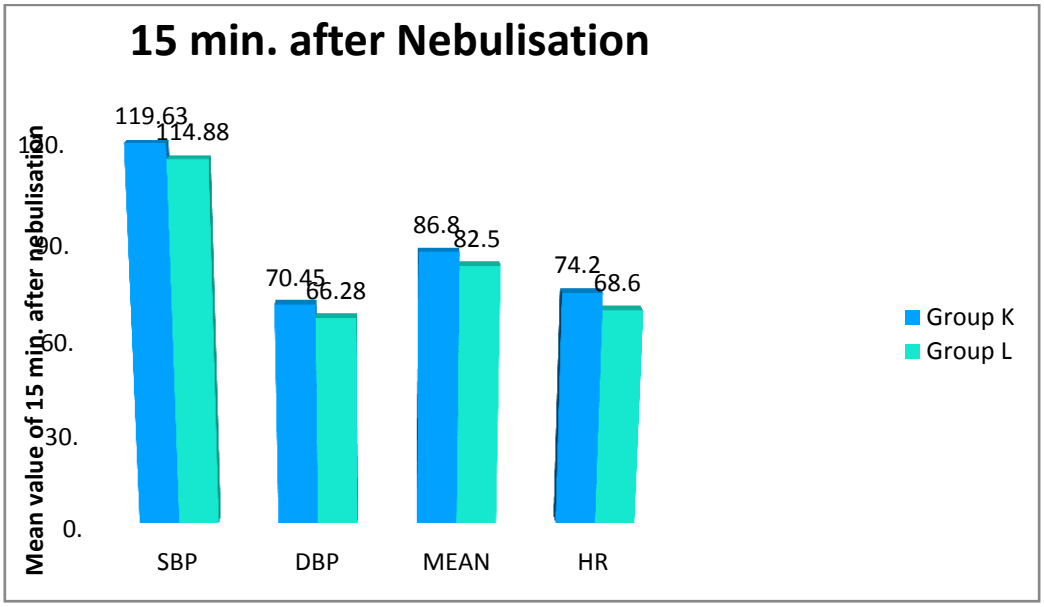
Table 5 demonstrates the hemodynamic parameters in pre nebulisation which demonstrates the mean blood pressure in Group K and Group L as 85.83±5.7 and 85.33±6.47 respectively. The difference in both the groups is statistically not significant as the p value and t value is 0.714 and 0.366 respectively . The mean heart

rate for group K and group L was found to be 74.00±8.8 and 72.5±8.0 respectively. The difference in both the groups is not significant as p value and t value are 0.431 and 0.790 respectively.

TABLE 6: 15 min. after Nebulisation

Variables	15 min. after Nebulisation		t value	p value
	Group K (Mean±SD)	Group L (Mean±SD)		
SBP	119.63±6.83	114.88±6.32	3.23	0.001
DBP	70.45±6.58	66.28±5.49	3.08	0.002
MEAN	86.8±5.37	82.5±5.41	3.567	0.0006
HR	74.2±8.2	68.6±7.1	3.369	0.001

Unpaired t test



Graph 6: 15 min. after Nebulisation

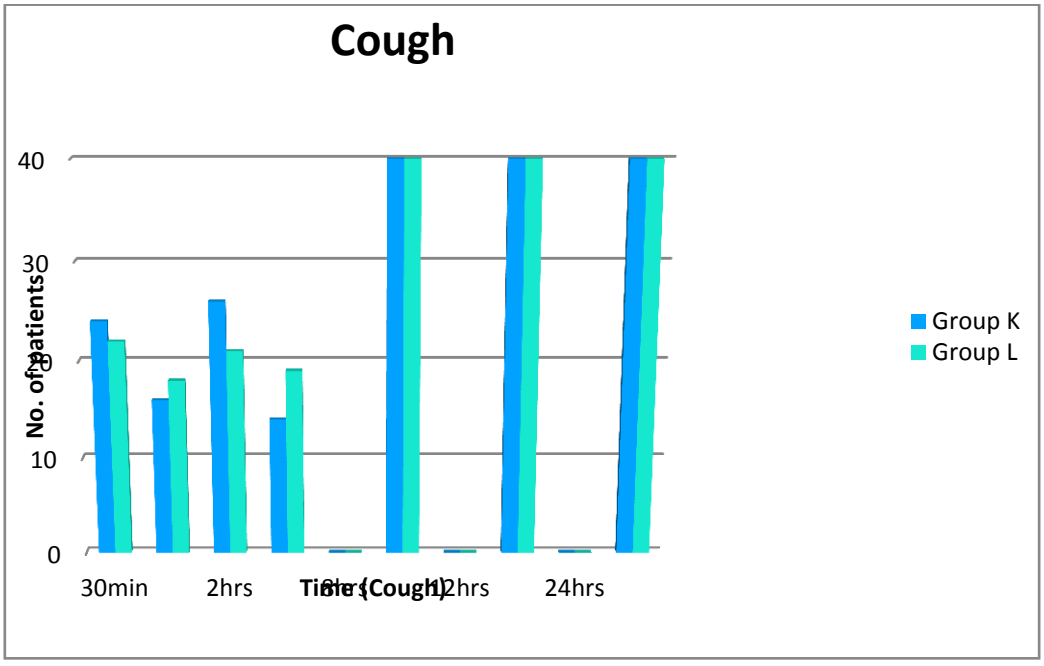
Fifteen min after nebulisation the Mean blood pressure in Group K was 86.8±5.37 and in Group L was 82.5±5.41. This difference was statistically significant (p-0.0006 & t -3.567). Also the differences in the SBP, DBP and HR was also significant statistically.The mean heart rate in group K and group L were 74.2±8.2 and 68.6±7.1 respectively. The difference in both groups is statistically significant (p-0.001 & t -3.369)

Post operative Cough:

TABLE 7: Cough

Time		Cough				p value
		Group K		Group L		
		N	%	N	%	
30min	Yes	24	60.00	22	55.00	0.651
	No	16	40.00	18	45.00	
2hrs	Yes	26	65.00	21	52.50	0.256
	No	14	35.00	19	47.50	
8hrs	Yes	0	0.00	0	0.00	-
	No	40	100.00	40	100.00	
12hrs	Yes	0	0.00	0	0.00	-
	No	40	100.00	40	100.00	
24hrs	Yes	0	0.00	0	0.00	-
	No	40	100.00	40	100.00	

Chi square test



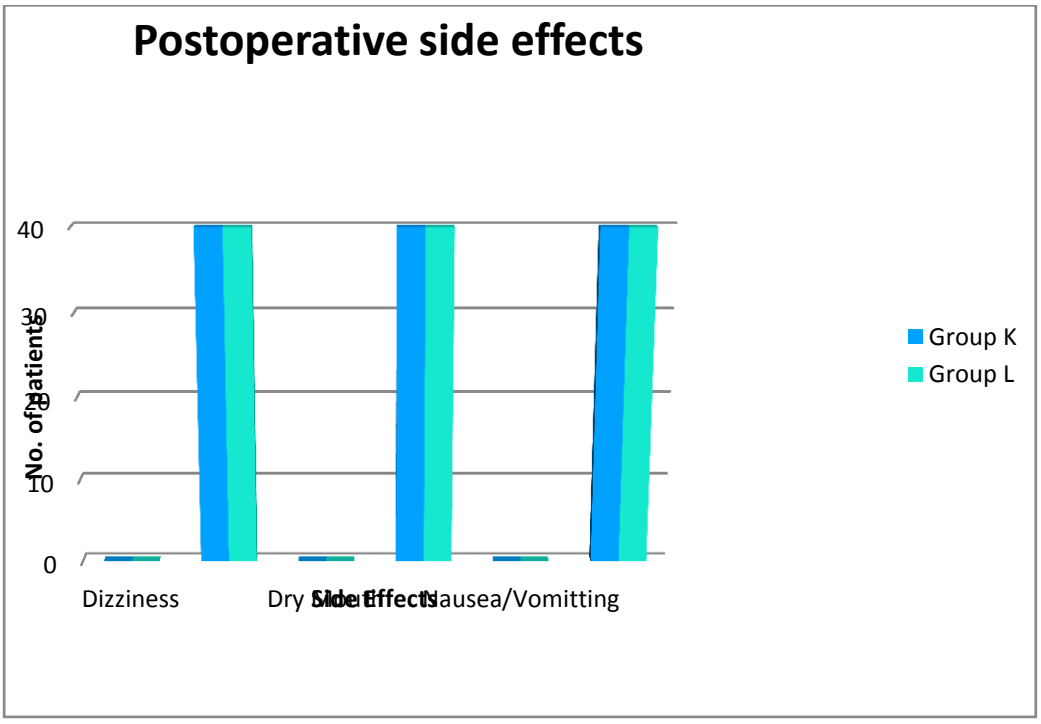
Graph 7 - Cough

Post operative cough evaluated from 30 minutes postoperatively to 24 hours postoperatively did not show any statistically significant difference in Group K and Group L (p-0.256) .

Postoperative side effects:

TABLE 8: Postoperative side effects

Side effects		Group K		Group L	
		N	%	N	%
Dizziness	Yes	0	0.00	0	0.00
	No	40	100.00	40	100.00
Dry Mouth	Yes	0	0.00	0	0.00
	No	40	100.00	40	100.00
Nausea/Vomitting	Yes	0	0.00	0	0.00
	No	40	100.00	40	100.00



Graph 8: Postoperative side effects

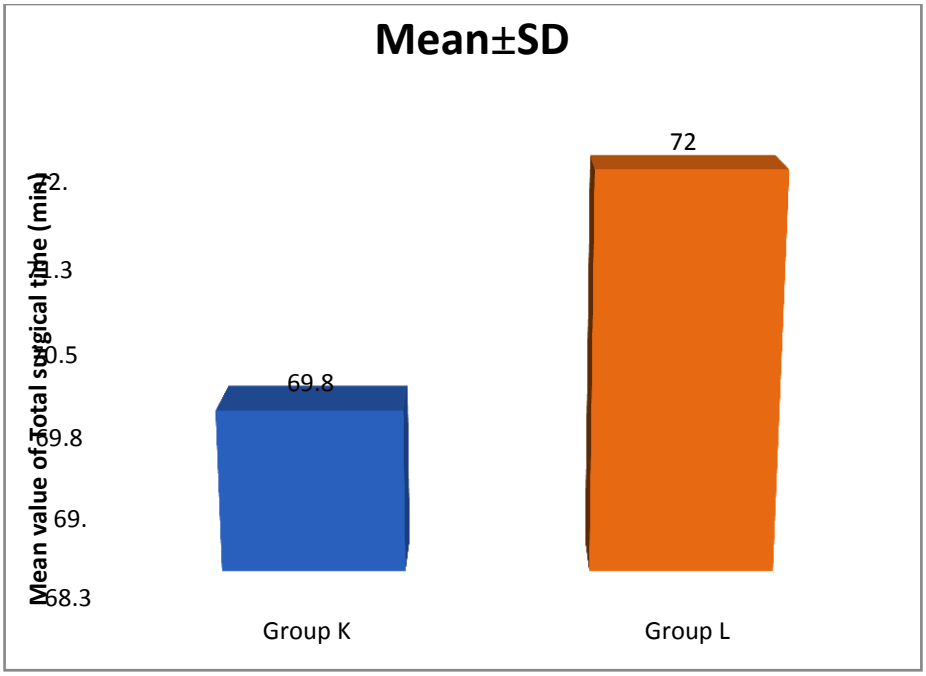
Postoperative side effects like Dizziness, Dry mouth and Nausea/ Vomiting were not seen in any of our patients in both the Groups K and L during the study .

Duration of Surgery and Anaesthesia:

TABLE 9: Duration of Surgery

Total surgical time (min.)	Group K	Group L
Median	60	57
Range	30-240	40-220
Mean±SD	69.8±35.2	72±37.5
t & p value	0.261, 0.794	

Unpaired t test



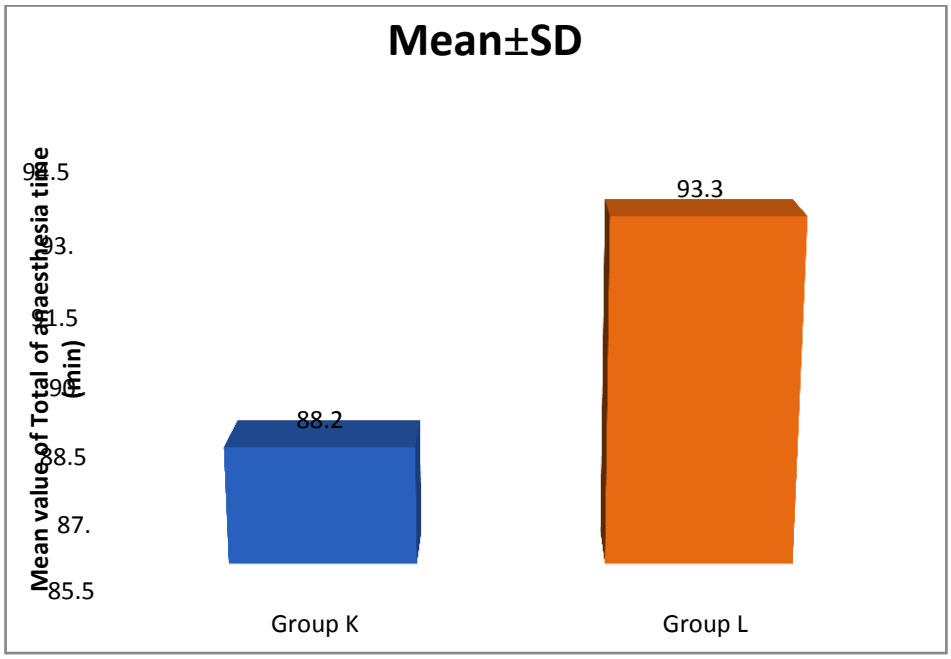
Graph 9 : Duration of Surgery

The mean of the total surgical time taken for Group K and Group L came out to be 69.8±35.2 and 72±37.5 respectively. The difference in both the groups was statistically not signicant (p value & t value are 0.261 and 0.794 respectively.)

TABLE 10 : Duration of Anaesthesia

Total of anaesthesia time (min.)	Group K	Group L
Median	80	85
Range	55-270	55-240
Mean±SD	88.2±38.0	93.3±41.9
t & p value	0.572, 0.568	

Unpaired t test



Graph 10: Duration of Anaesthesia

There was no significant difference in both the Group K and Group L in the duration of surgery (p- 0.794) or duration of anaesthesia (p-0.568).

Hoarseness:

TABLE 11: Hoarseness

Time	Hoarseness		p value
	Group K (Mean±SD)	Group L (Mean±SD)	
30 mins	0.8±0.40	0.07±0.26	**<0.0001**
2 hrs	0.92±0.82	0.22±0.42	**0.0003**
8 hrs	0.42±0.59	0.22±0.42	0.204
12 hrs	0.00±0.00	0.00±0.00	NA
24 hrs	0.00±0.00	0.00±0.00	NA

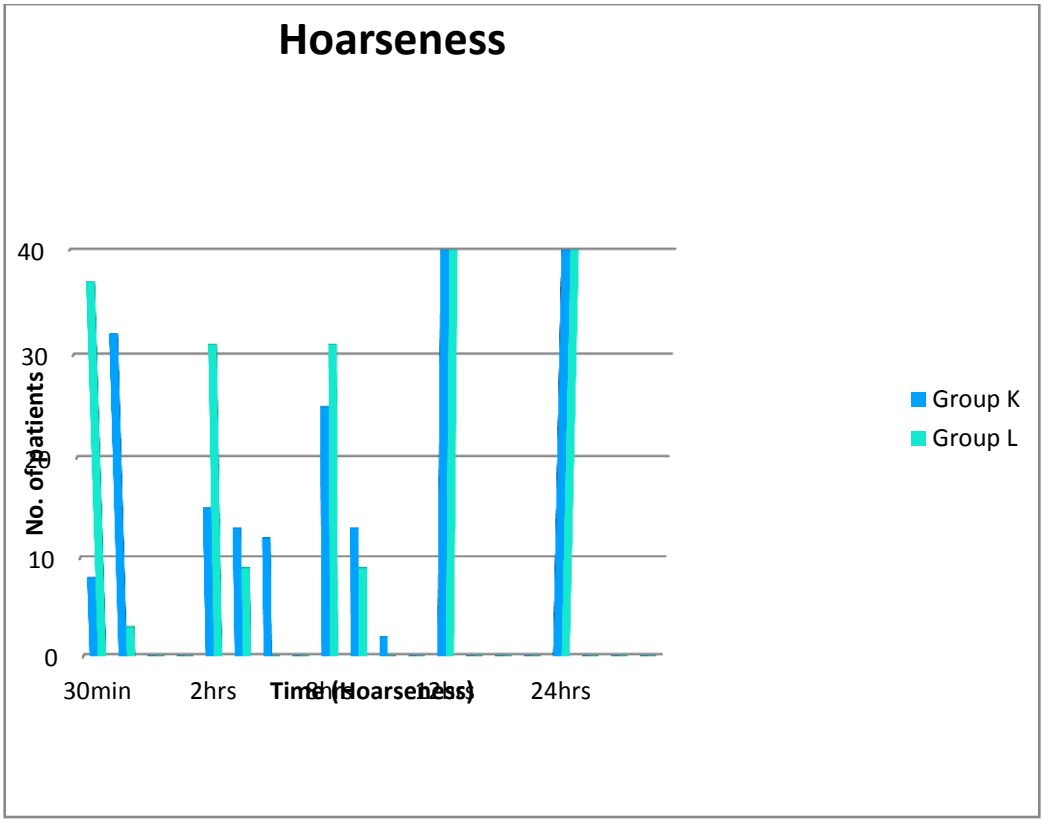
Wilcoxon rank sum test

At 30 min , in Group K the mean with standard deviation was 0.8±0.40 and 0.07±0.26 for Group L for grade 1 of hoarseness. Rest of the patients had no hoarseness. The difference was statistically significant ($p < 0.0001$).

At 2 hours in Group K the mean value with standard deviation was 0.92±0.82 whereas in Group L it was 0.22±0.42. The difference was statistically significant ($p < 0.0003$).

At 8 hours also in Group K the mean with standard deviation was 0.42±0.59 and in Group L was 0.22±0.42 . The difference was statistically not significant ($p – 0.204$).

None of the patients in Group K or Group L showed evidence of hoarseness at 12 or 24 hours after the procedure.



Graph 11: Hoarseness

Post-Operative Sore Throat

TABLE 12 :

Time	Post Operative Sore Throat Assessment: Grade 1-4		p value
	Group K (Mean±SD)	Group L (Mean±SD)	
30 mins	1.00±0.00	1.12±0.33	NA
2 hrs	1.22±0.42	1.92±0.72	**<0.0001**
8 hrs	1.4±0.59	2.25±0.43	**<0.0001**
12 hrs	1.3±0.51	1.67±0.57	**0.006**
24 hrs	1.02±0.15	1.17±0.38	0.228

Wilcoxon rank sum test

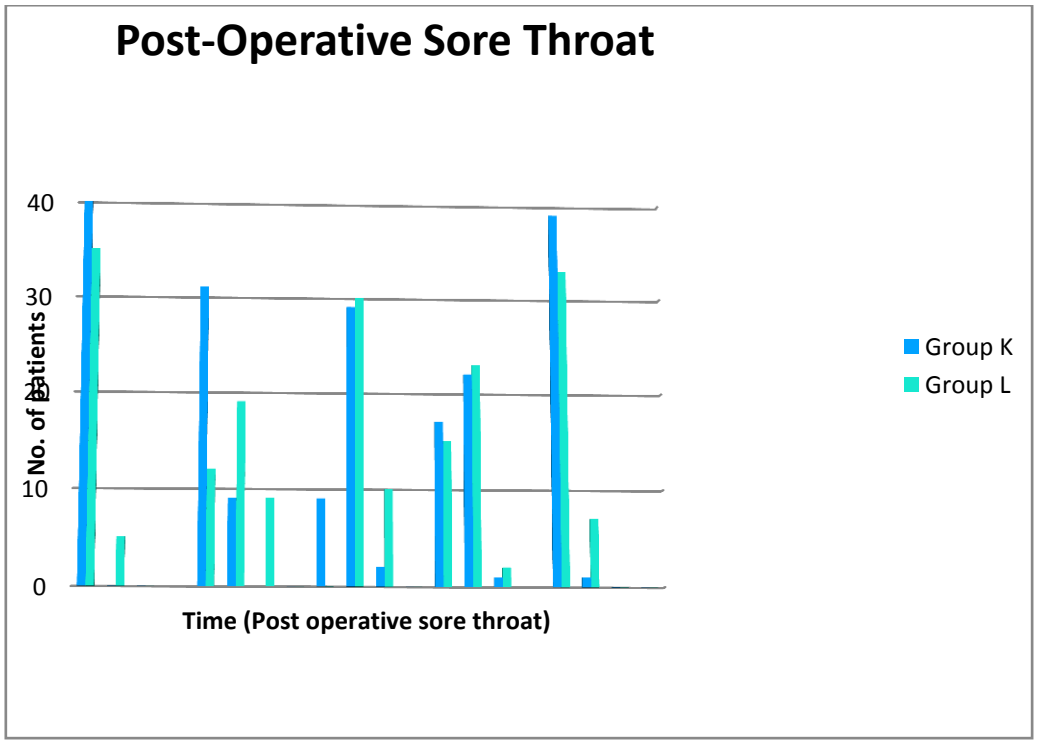
Evaluation at 30 minutes revealed that the mean of sore throat in Group K was 1.00±0.00 and in 1.12±0.33 in Group L . The difference was statistically not significant .

At 2 hours in Group K the mean of sore throat occurence was 1.22±0.42 and 1.92±0.72 In Group L. The difference was statistically found to be significant (p< 0.0001) .

At 8 hours amongst Group K there mean for sore throat occurence was 1.4±0.59 and 2.25±0.43 in Group L . The difference was statistically significant (p<0.0001) .

At 12 hours in Group K the mean was 1.3±0.51 and The value in Group L was 1.67 0.57. It was determined that the difference was statistically significant (p- 0.006).

At 24 hours in Group K mean value for sore throat was 1.02±0.15 whereas in Group L it was 1.17±0.38 . The difference however was statistically not significant (p- 0.228) .



Graph 12: Post Operative Sore throat

DISCUSSION

Many of the general anaesthetic procedures in conventional anaesthetic management involve endotracheal intubation to protect the airway . Postoperative sore throat (POST) is a frequent side effect of endotracheal intubation, albeit a minor one[51]. The unpleasant feeling that is caused to the patient by sore throat, leaves the patient feeling dissatisfied and with an unpleasant experience post operatively . Thus making it among the most unfavourable side effects in the immediate wake of anesthesia[44]. Although considered as a minor complication , it may cause significant post-operative morbidity and patient dissatisfaction[3].

A fairly diverse constellation of symptoms and indicators is represented by post-operative sore throat ranging from laryngitis, tracheitis to hoarseness , cough or even dysphagia with an The incidence following endotracheal intubation ranges from (21-65%)[50]. Patients ranked post-operative sore throat as the eighth unfavourable impact in the post-operative period[32].

The aetiology for occurrence of postoperative sore throat being multifactorial includes factors such as patient's sex, age, the application of succinylcholine[51], the usage of larger tracheal tubes[82], the design of the cuff, and intra cuff pressure[44]. POST may also be caused due to variables such as low airway humidity, trauma from airway insertion, suctioning, increased anaesthetic air flow rates, and surgical intervention of the airway and neighboring tissue[45]. The stiff tubes' forces cause laryngeal harm[37] with mucosal dehydration to most frequently occur posteriorly over the cricoid plate in addition to the vocal processes of the arytenoids.

Identification and anticipation of such risk factors allows POST prevalence should be minimised, and post-anesthesia consequences should be managed, by anaesthesia providers. Multimodal strategy has been applied to minimize POST. Various non-pharmacological and pharmaceutical strategies are covered in this. Some non-pharmacological practices to limit the incidence of POST also use relatively small endotracheal tubes[82], coating the tube with water-soluble jelly[73], meticulous airway instrumentation, intubation after ensuring adequate muscle relaxation, gentle oropharyngeal suctioning, significantly reducing intra-cuff pressure[51], and then extubating once the tracheal tube cuff is fully deflated.

Pharmacological analgesia is the mainstay of treatment for postoperative sore throat. Judicious use of adjuvant agents such as nonsteroidal anti-inflammatory drugs, lidocaine, and beclomethasone , ketamine , magnesium sulphate, may improve postoperative analgesia and decrease the side effects[13] .

Recently an increasing emphasis has been made on the use of nebulisation pre operatively with various agents as a part of management for post operative sore throat . The efficacy of nebulisation pre operatively in providing postoperative relief and reducing the incidence of sore throat has been well documented in varied studies worldwide [20].

We have studied the effects and comparison of ketamine and lignocaine nebulisation for prevention of POST . Both the drugs used in this study are known to have anti-inflammatory properties and anti nociceptive action which helps combat the post operative sore throat . Ketamine, a phencyclidine derivative and noncompetitive N-methyl-D-aspartate (NMDA) blocker, is regarded as a legitimate treatment for relieving POST since it has peripheral analgesic effects while also reducing local inflammation. While lignocaine probably works to relieve sore throats by blocking nerve conduction by limiting sodium ion entry during the upstroke of an action potential and by suppressing the excitatory sensory C fibres in the airways, it also inhibits transmission of nerve impulses by decreasing sodium ion entry during downstrokes as well[13].

In our study the number of male patients was 22 in ketamine group & 20 in lignocaine group. The number of female patients was 18 in ketamine group and 20 in lignocaine group. When compared the difference was not found to be statistically significant (p=0.6).

When succinylcholine is used to aid endotracheal intubation, there has been a reported increase in the incidence of sore throat in patients (14% in the succinylcholine group versus 17% in the control group) 18. Thus, in our investigation, succinylcholine was not used for endotracheal intubation. Vecuronium was employed to aid all intubations.

According to Stout D. M. et al(1987)'s study[82] on the use of cuffed tubes, larger size tubes had an increased prevalence of sore throats than smaller size tubes. For this

rationale, in our study, we selected 7.5 mm tubes for female patients and 8.0 mm tubes for male patients in both groups.

According to previous research, POST is linked to an increase in cuff pressure. Excessive endotracheal tube inflation creates excessive pressure on the tracheal wall, which impairs the perfusion of the tracheal mucosa and leads to ischemic necrosis of that tissue. Consequently, in our study, we kept the intra-cuff pressure between 18 and 22 mm hg in both groups as blood flow in the tracheal mucosa starts to decline when pressure in the endotracheal tube cuff surpasses 22 mm hg and declines considerably when the pressure reaches 30 mm hg[85].

To reduce sore throat in the postoperative phase, numerous investigators have employed a variety of strategies for questioning for complaints . In a study conducted in 1987, Harding C. J. et al.[78] found a greater occurrence of sore throats by asking straightforward questions. Therefore, in our investigation, we used a scale in which the patient was inquired about his postoperative discomfort. A straightforward question regarding sore throat, hoarseness, and cough was asked

In contrast to nebulization with lignocaine 20 minutes prior to induction, our study demonstrated that nebulization with 50mg of ketamine diluted with 4 ml of NS successfully reduced the incidence & severity of post-operative sore throat. In contrary to 5/40 individuals in the lignocaine group, none of the patients in the ketamine group experienced POST thirty minutes after being extubated.

At two hours after extubation, 19/40 patients in lignocaine group and 09/40 patients in the ketamine group reported with mild sore throat. 9/40 participants in the lignocaine group reported moderate sore throat. The difference in POST incidence at 2 hours after extubation was determined to be statistically significant (p 0.001) when evaluated statistically.

At eight hours after extubation, 12 out of forty patients receiving ketamine reported having a mild sore throat and 2/40 of moderate sore throat while 30/40 patients experienced mild sorethroat and 10/40 patients in the lignocaine group reported mild sore throat. The difference in POST incidence at 0, 2, and 8 hours after extubation was discovered to be statistically significant (p 0.0001) when compared.

At 12 hours after extubation, 29/40 of Group K reported no sore throat, whereas only 10/40 complained of mild sore throat while 15/40 Patients in the lignocaine group did not report sore throat, whereas 23/40 did. However, only one patient in the ketamine group exhibited mild symptoms, while two still had a moderate sore throat in lignocaine group.

Only one patient in the ketamine group continued to experience mild sore throats 24 hours after extubation, whereas 7/40 of the patients in the group L complained of mild symptoms . The difference between POST incidence at 12 and 24 hours after extubation was found to be statistically insignificant when compared (p-0.228).

This demonstrates that 15 minutes prior to the onset of general anaesthesia, ketamine nebulization dramatically lowers the incidence and severity of POST. nebulisation with lignocaine.

The incidence of hoarseness also diminished over time, which was consistent with Rajan S. et al's analysis[60] in which patients who were nebulized with ketamine and magnesium sulphate saw a similar trend.In our study the incidence of hoarseness was found to be statistically significant with p value <0.0001 at 30 minutes post operatively and p value =0.0003 at 2 hours post operatively . None of the patients in Group K or Group L showed evidence of hoarseness at 12 or 24 hours after the procedure. The incidence of hoarseness was found to only decrease with passage of time in both groups .

Post operative cough evaluated from 30 minutes postoperatively to 24 hours postoperatively did not show any statistically significant difference in Group K and Group L (p-0.256) both .

Both groups showed no signs of any side effects, such as vomiting, dry mouth, or nausea.

The results of our investigation are consistent with research by Ranjana et al (2020)[40]. The author of this paper investigated the effects of ketamine nebulisation versus lignocaine nebulisation for POST. Eighty patients undergoing surgeries under GA were a part of the trial and split into two groups of forty each; one group received ketamine nebulization 50 mg, and the other group received lignocaine 2% 2ml 15

minutes before the onset of general anaesthesia .They observed that the ketamine group had a reduced incidence and severity of POST as compared to lignocaine group. In these 2 trial groups, the prevalence of postoperative cough decreased in 24 hours [40]which was similar to the previous study by Park SY et al[79] which had also reported no significant difference in the incidence of cough postoperatively following ketamine gargle .The incidence of hoarseness was found to decrease with time and was seen to be the earlier study by Park SY et al[79]. also discovered no difference in the incidence of cough postoperatively with ketamine gargle. The incidence of hoarseness was shown to decrease over time, which was in keeping with a prior study by Rajan S. et al., who likewise observed a decrease in hoarseness over time in patients who were nebulized with ketamine and magnesium sulphate. Both groups showed no signs of adverse effects . This outcome can be explained by the fact that inhaled medications have minimal systemic absorption, which leads to comparatively lesser systemic side effects. This outcome was in line with the results of the research by Mostafa RH et al.[20], Salama AK and El-badawy AM[80].

Our study's results also agreed with those of the following studies.:

Vaghela AP et al (2019)[9] , compared the patients undergoing general anaesthesia for developing a sore throat post surgery when nebulisation with ketamine and lignocaine is done . It was concluded that preoperative nebulization is a simple, safe and effective technique to reduce incidence of post-operative sore throat, hoarseness of voice and cough. There was a decrease in the likelihood of post-operative sore throat in ketamine group as compared to the lignocaine group .

The results of our research also supported the following study done by Rao, et al(2015)[18] on lignocaine nebulization to see prevention of POST. This study was done to compare the effect of lignocaine for the treatment of post-operative sore throat. The study establishes the effectiveness of lignocaine nebulization for the treatment of POST resulting from endotracheal intubation. Improvement in the severity of POST was observed after the lignocaine nebulization as compared with the control group that recorded nebulisation with normal saline.Therapeutic lignocaine nebulization was well tolerated by the patients and provides immediate relief, except for transient numbness of oropharynx and bitter taste in the mouth. Our study also

establishes the effectiveness of lignocaine nebulization for the treatment of POST resulting from endotracheal intubation.

Derlin Thomas *et al* (2018) [14], evaluated the effectiveness of nebulised ketamine in allievating POST following general anaesthesia with tracheal intubation ina randomised controlled clinical trial among 96 patients. There was statistically significant reduction in the incidence of POST in ketamine group when compared to that of saline, at 2, 4, 6,12, and 24 hours postoperatively. Conclusively , preoperative administration of nebulized ketamine effectively reduced the incidence and severity of POST in patients undergoing GA with endotracheal intubation, with no adverse effects.

In a study of 100 patients by Ahuja *et al.*,[20] ,(2015) it was observed that the incidence of POST in ketamine group was statistically significant only at 2 h and 4 h postoperatively . POST was noted in 23 patients (46%) in the saline group and 10 patients (20%) in the ketamine group, representing a 33% overall frequency. In conclusion , ketamine nebulization when given preoperatively lessened the incidence and severity of POST, particularly during the initial hours of postoperative period with no adverse effects.

To determine the dose-dependent efficacy of ketamine nebulization in mitigating post-operative sore throat caused upon tracheal intubation, Reddy M et al. (2017)[38] assessed 90 patients. Nebulized, preservative-free ketamine was delivered to Group A at 0.5 mg/kg, Group B at 1 mg/kg, and Group C at 1.5 mg/kg body weight for 15 minutes before to intubation. It was observed that nebulized ketamine at a dose of 0.5mg/kg was comparatively less effective than 1 mg/kg and 1.5 mg/kg and the difference was statistically significant. 1mg/kg and 1.5mg/kg of nebulized ketamine were better and Reduces post-operative sore throat frequency and severity equally well.

Charan Set al (2018) [17]studied to compare the efficacy of inhalation of different doses of ketamine for prevention of post operative sore throat. A prospective, randomized, and double-blind controlled trial Was conducted where 100 patients divided in two groups(50 patients each group) received nebulisation with 25 mg and 50 mg ketamine respectively . It was then concluded that irrespective of the doses

(both 25 mg and 50 mg) ketamine was equally effective in both the dose for prevention of the post operative sore throat .

Ramadevi P *et al(2019),*[26] conducted a prospective randomised control trial where 90 patients were randomised into three groups of 30 each receiving ketamine nebulisation , lignocaine nebulisation and control group receiving normal saline nebulisation each . As a result , it was observed that Ketamine nebulization and lignocaine nebulization provided less discomfort to the patient and the severity of sore throat was progressively less over 24 hrs in the post operative period. To conclude ketamine nebulization provided better relief of post operative sore throat as compared to lignocaine nebulization and no nebulization.

CONCLUSION

In patients undergoing tracheal intubations under general anaesthesia, preoperative nebulization with ketamine and lignocaine is a quick and painless technique to lessen the likelihood of postoperative sore throat with no adverse effects.

Early postoperative ST was reduced by ketamine . The long-term outcome as well, postoperatively, was better with ketamine than with lignocaine .

SUMMARY

We carried out a study on 80 patients who were scheduled to undergo elective surgeries under general anaesthesia with an endotracheal tube to determine whether ketamine as well as lignocaine nebulization altered the incidence and severity of postoperative sore throat. Prior to surgery, the patients were given lignocaine nebulization(Group L) or ketamine nebulization (Group K) .

After receiving approval from the institutional ethical committee and all patients' signed informed consent forms, the study was carried out. A thorough pre-anaesthetic examination was performed. and all relevant investigations were done for the participants . The patients were divided into 2 groups using a computer-generated randomization table: Group K received Ketamine nebulization, whereas Group L received Lignocaine nebulization (Group L). Patients were nebulized with 50 mg.with 4ml of normal saline, 20 mins before induction or nebulised with Lignocaine 2% 2ml with 2ml of normal saline, 20 mins before induction based on the group they were allocated to through the computer generated randomisation . Other parts of anaesthetic management were standardised throughout the study .

We questioned patients following their surgery for any complaints of cough , hoarseness and post operative sore throat .

We observed that We concluded that age, sex , weight , duration of surgery and duration of anaesthesia were not comparable as significant parameters. At 2 hours and 8 hours after extubation, the incidence of POST was substantially reduced in the group that received ketamine nebulization, with a p value< 0.0001. It was then concluded that pre operative nebulisation with ketamine yielded better results for prevention of POST as compared to nebulisation with lignocaine .

The incidence of hoarseness was found to be statistically significant between ketamine and lignocaine group with p <0.001 at 30 minutes and p=0.0003 at 2 hours post operatively . The incidence was found to decrease with passage of time .

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ANNEXURE 1

PROFORMA

1.DEMOGRAPHIC PROFILE :

Name	
Age	
Sex	
Weight	
Diagnosis	
Operation proposed	
MRD No.	
Surgery Unit	
Date	

2.GENERAL EXAMINATION:

GENERAL CONDITION	
HEART RATE	
BLOOD PRESSURE	
TEMPERATURE	
SPO2	
MOUTH OPENING	
MPG GRADE	
NECK MOBILITY	
ORAL HYGIENE	
ASA GRADE	

3. PRE OPERATIVE VITAL CHARTING :

PARAMETERS	PRE NEBULISATION	15 MINS AFTER NEBULISATION	IMMEDIATELY BEFORE INDUCTION
HEART RATE			
BLOOD PRESSURE			

4. POST OPERATIVE SORE THROAT ASSESMENT :

POST SEVERITY SCORE	30 MINS AFTER EXTUBATION	2 HRS LATER	8 HRS LATER	12 HRS LATER	24 HRS LATER
GRADE 1					
GRADE 2					
GRADE 3					
GRADE 4					

5.HOARSENESS :

HOARSENESS	30 MINS	2 HRS	8 HRS	12 HRS	24 HRS
GRADE 0					
GRADE 1					
GRADE 2					
GRADE 3					

6.COUGH :

COUGH	30MINS	2 HRS	8 HRS	12 HRS	24 HRS
YES					
NO					

8 . SIDE EFFECT PROFILE OF THE DRUG:

SIDE EFFECT	GROUP A	GROUP B
Dizziness		
Dry mouth		
Edema		
Nausea/vomiting		
Weakness		

ANNEXURE 2

CONSENT FORM

I, _____ Son/ Daughter/ Wife of _____ Resident of _____ Hereby declare that I give my full, free and voluntary informed consent in the thesis

"**Comparison of nebulisation with Ketamine vs Lignocaine for prevention of post operative sore throat in General anaesthesia surgeries** "

Dr._____ has informed me to my full satisfaction, in the language I understand, about the purpose, nature of study and various laboratory investigations for

the study to be carried out. I have been informed about the duration of the study and instructions to be followed during the study period.

I give full consent for being enrolled in the above study and I reserve my rights to withdraw from this study, whenever I wish without prejudice of my right to undergo further treatment at Santosh Hospital, Ghaziabad U.P.

Patient's/ Patient's relative's signature
Or thumb impression

Doctors signature

Name:

Date:

We have witnessed that the patient signed the above form in the presence of his free will after fully understanding its content

1.
Signature of Witness
Name

2.
Signature of Investigator
Name

Dr. Ishita Govil
Post graduate Student
Batch 2020- 2023
Santosh Medical College & Hospital
Ghaziabad – 201001 (U.P.)

ANNEXURE 3

सहमति

मरीज नाम: **आयु** : **सेक्स**:

पता:

मैं _____ अध्ययन प्रक्रिया "**Comparison of nebulisation with Ketamine vs Lignocaine for prevention of post operative sore throat in General anaesthesia surgeries** " **के स्थानीयकरण में मार्गदर्शन करना, में भाग के लिए अनुमति देने के लिए तैयार हूँ, जो की** Dr (**चिकित्सक**) ISHITA GOVIL **पेडियेटिक्स के विभाग द्वारा, संतोष मेडिकल कॉलेज और अस्पताल में किया जा रहा । उनके परिणामों और मुझे समझ में भाषा में आयोजित किया जा रहा अध्ययन की प्रकृति समझाया गया है। मैं अध्ययन के लिए पूर्ण, स्वतंत्र और स्वैच्छिक सहमति देने के लिए तैयार हूँ**

1 **गवाह के हस्ताक्षर** **रोगी के हस्ताक्षर**

2 **गवाह के हस्ताक्षर** **दिनांक**:

Signature of Investigator
Dr. Ishita Govil
Post graduate Student
Batch 2019- 2022
Santosh Medical College & Hospital
Ghaziabad – 201001 (U.P)

ANNEXURE 4

LIST OF ABBREVIATIONS

1.	GA	–	GENERAL ANAESTHESIA
2.	POST	–	POST OPERATIVE SORE THROAT
3.	ST	–	SORE THROAT
4.	HOV	–	HOARSNESS OF VOICE
5.	HRS	–	HOURS
6.	MO	–	MOUTH OPENING
7.	ETT	–	ENDOTRACHEAL TUBE
8.	SD	–	STANDARD DEVIATION
9.	LA	–	LOCAL ANESTHETIC
10.	NSAID	–	NON STEROIDAL ANTI INFLAMMATORY DRUGS
11.	CO2	–	CARBON DIOXIDE
12.	I M	–	INTRA MUSCULAR
13.	I V	–	INTRA VENOUS
14.	CNS	–	CENTRAL NERVOUS SYSTEM
15.	CVS	–	CARDIOVASCULAR SYSTEM
16.	RS	–	RESPIRATORY SYSTEM
17.	AS	–	AUTONOMIC SYSTEM
18.	HR	–	HEART RATE
19.	SBP	–	SYSTOLIC BLOOD PRESSURE
20.	DBP	–	DIASTOLIC BLOOD PRESSURE
21.	MAP	–	MEAN ARTERIAL PRESSURE
22.	SPO2	–	OXYGEN SATURATION
23.	ETCO2	–	END TIDAL CARBON DIOXIDE
24.	DOS	–	DURATION OF SURGERY
25.	ASA	–	AMERICAN SOCIETY OF ANAESTHESIOLOGY
26.	MPG	–	MALAMPATTI GRADING

ANNEXURE 5

ETHICAL COMMITTEE CLEARANCE

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act, 1956)

F. No. SU/2021/1830[39] Dated: 17.07.2021

Subject: Grant of Ethical Clearance for Thesis Protocol Topic **"COMPARISON OF NEBULISATION WITH KETAMINE V/S LIGNOCAINE FOR PREVENTION OF POST-OPERATIVE SORE THROAT AFTER SURGERIES UNDER GENERAL ANAESTHESIA.",** submitted by **Dr. Ishita Govil,** MD/MS student of Batch 2020-2021, Department of **Anaesthesia**.

*****

With reference to his/her request for grant of Ethical Clearance for the Thesis Protocol entitled **"COMPARISON OF NEBULISATION WITH KETAMINE V/S LIGNOCAINE FOR PREVENTION OF POST-OPERATIVE SORE THROAT AFTER SURGERIES UNDER GENERAL ANAESTHESIA."**, **Dr. Ishita Govil** is informed that the Thesis Protocol submitted by him/her was considered by the **Screening Committee** of the Santosh Medical College & Hospital in its meetings held on 19.03.2021, 22.03.2021, 24.03.2021, 25.03.2021, 26.03.2021, 27.03.2021 and 06.04.2021. The recommendations of the **Screening Committee** were considered in detail by the Institutional **Ethics Committee** in its meeting held on **12.07.2021** and the same was **approved** by the **Ethics Committee**.

He /She is informed accordingly for further necessary action.

[Dr. V. P. Gupta]
REGISTRAR

SANTOSH "DEEMED TO BE UNIVERSITY" REGISTRAR GHAZIABAD, NCR DELHI

Dr. Ishita Govil
MD/MS student of batch 2020-2021
Department of Anaesthesia
Email: ishitagovil2705@gmail.com

Copy to:

1. The Vice Chancellor
2. The Dean, SMC&H
3. The Dean – Research
4. The Dean – Academics
5. The Director - IQAC
6. Dr. Suveer Sharma (Guide)
7. HOD of **Anaesthesia**

ANNEXURE 6

PLAGIARISM CERTIFICATE

Ouriginal by Turnitin

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Sources included in the report

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W	URL: https://www.worldwidejournals.com/international-journal-of-scientific-research-(IJSR)/recent_i... Fetched: 2022-09-14 14:03:44	1

MASTERCHART (GROUP A- PATIENTS RECEIVING KETAMINE NEBULISATION)

S. No.	UHID	Demographic Profile				GENERAL EXAMINATION								Pre Operative Vital Charting									Hoarseness (GRADE0-3)					Cough(yes/no)					Post Operative Sore Throat Assessment: Grade 1-4					Total surgical time (min)	Total anaesthesia time (min)	SIDE EFFECTS(YES/NO)				
							BP							Pre Nebulisation				15 Mins After Nebulisation																										
															BP				BP																								
		Age	Sex	Weight (kg)	Operation	HR	SBP	DBP	MEAN	SpO2 (%)	Mouth Opening (FINGER TEST)	MPG Grade	ASA Grade	HR	SBP	DBP	MEAN	HR	SBP	DBP	MEAN	30 mins	2 hrs	8 hrs	12 hrs	24 hrs	30 mins	2 hrs	8 hrs	12 hrs	24 hrs	30 Mins	2 Hrs	8 Hrs	12 Hrs	24 Hrs			Dizziness	Dry mouth	Oedema	Nausea	Weakness (Generalised)
1	17112380	48	F	58	MicrodirectLARYNGOSCOPY WITH BIOPSY FOR ?GLOTTIC CA	68	122	84	97	99	3	3	2	68	122	84	97	72	124	76	92	0	1	2	0	0	yes	yes	no	no	no	1	1	1	1	1	30	55	NO	NO	NO	NO	NO
2	17113405	34	M	65	TYMPANOPLASTY	64	118	66	83	100	3	2	1	64	118	66	83	65	121	74	90	0	1	0	0	0	no	yes	no	no	no	1	1	2	1	1	65	90	NO	NO	NO	NO	NO
3	17115920	45	M	62	MODIFIED RADICAL	76	123	65	84	100	3	1	1	76	123	65	84	74	128	67	87	1	2	1	0	0	no	no	no	no	no	1	1	1	1	1	145	160	NO	NO	NO	NO	NO
4	17114715	39	F	59	TYMPANOPLASTY	74	109	67	81	100	3	2	1	74	109	67	81	76	117	72	87	1	1	0	0	0	yes	yes	no	no	no	1	1	1	1	1	55	65	NO	NO	NO	NO	NO
5	17152253	40	F	65	LAP CHOLECYSTECTOMY	68	117	69	85	99	3	1	1	68	117	69	85	71	121	84	96	1	2	1	0	0	yes	yes	no	no	no	1	1	1	1	1	45	60	NO	NO	NO	NO	NO
6	17153235	52	M	58	LAP CHOLECYSTECTOMY	65	121	65	84	99	3	2	2	65	121	65	84	68	122	65	85	0	1	0	0	0	no	yes	no	no	no	1	2	2	1	1	50	65	NO	NO	NO	NO	NO
7	17105968	28	F	65	RIGHT BREAST ABSCESS DRAINAGE	83	134	76	95	100	3	1	1	83	134	76	95	85	132	76	95	0	1	2	0	0	no	no	no	no	no	1	1	1	1	1	60	75	NO	NO	NO	NO	NO
8	17153772	45	F	66	LAP CHOLECYSTECTOMY	79	129	74	92	99	3	1	1	79	129	74	92	78	128	76	93	1	2	1	0	0	no	no	no	no	no	1	2	2	1	1	75	95	NO	NO	NO	NO	NO
9	17135436	23	M	67	LAP CHOLECYSTECTOMY	64	118	73	88	100	3	1	2	64	118	73	88	69	120	73	89	1	1	0	0	0	yes	yes	no	no	no	1	1	1	2	1	55	70	NO	NO	NO	NO	NO
10	17095698	37	M	68	LAP CHOLECYSTECTOMY	76	107	65	79	99	3	1	1	76	107	65	79	77	110	65	80	1	1	0	0	0	yes	yes	no	no	no	1	1	2	1	1	65	80	NO	NO	NO	NO	NO
11	17153846	30	M	63	LEFT BREAST EXCISION	78	113	59	77	100	2	2	2	78	113	59	77	78	120	60	80	1	2	1	0	0	yes	yes	no	no	no	1	1	1	2	1	120	145	NO	NO	NO	NO	NO
12	17107242	30	M	52	LAP CHOLECYSTECTOMY	65	122	64	83	100	3	2	1	65	122	64	83	62	123	65	84	1	1	0	0	0	no	no	no	no	no	1	2	2	2	1	90	125	NO	NO	NO	NO	NO
13	17107040	35	F	61	LAP CHOLECYSTECTOMY	102	127	76	93	100	3	1	1	102	127	76	93	99	125	76	92	0	0	1	0	0	yes	yes	no	no	no	1	1	1	1	1	65	90	NO	NO	NO	NO	NO
14	17157890	40	M	48	LAP CHOLECYSTECTOMY	88	128	67	87	99	3	1	2	88	128	67	87	87	120	70	87	1	0	0	0	0	yes	yes	no	no	no	1	1	1	2	1	50	60	NO	NO	NO	NO	NO
15	17168118	23	F	44	LAP CHOLECYSTECTOMY	76	118	72	87	100	3	1	1	76	118	72	87	75	118	72	87	1	2	1	0	0	yes	yes	no	no	no	1	1	2	1	1	55	70	NO	NO	NO	NO	NO
16	17157371	35	M	72	LAP CHOLECYSTECTOMY	69	121	77	92	99	3	2	1	69	121	77	92	70	122	75	91	1	0	0	0	0	no	no	no	no	no	1	1	1	1	1	60	75	NO	NO	NO	NO	NO
17	17167251	45	M	69	LAP CHOLECYSTECTOMY	76	125	69	88	100	3	2	2	76	125	69	88	75	125	69	88	1	1	0	0	0	no	yes	no	no	no	1	2	2	1	1	50	65	NO	NO	NO	NO	NO
18	17170368	44	F	45	LAP CHOLECYSTECTOMY	79	134	72	93	97	3	1	2	79	134	72	93	80	128	84	99	1	0	0	0	0	yes	yes	no	no	no	1	1	1	1	1	45	60	NO	NO	NO	NO	NO
19	17166662	20	F	62	RIGHT BREAST FIBRIADENOMA	65	127	58	81	98	3	2	1	65	127	58	81	65	128	61	83	1	1	0	0	0	yes	no	no	no	no	1	1	1	1	1	60	80	NO	NO	NO	NO	NO
20	17174698	51	M	50	LAP CHOLECYSTECTOMY	68	122	62	82	99	3	1	2	68	122	62	82	70	120	60	80	1	1	0	0	0	yes	yes	no	no	no	1	1	2	1	1	100	120	NO	NO	NO	NO	NO
21	17187546	26	F	52	RIGHT BREAST FIBRIADENOMA	64	118	72	87	99	2	1	1	64	118	72	87	64	118	70	86	1	2	1	0	0	no	no	no	no	no	1	1	1	1	1	70	90	NO	NO	NO	NO	NO
22	17182954	23	F	47	RIGHT BREAST ABSCESS DRAINAGE	74	106	64	78	98	3	2	1	74	106	64	78	75	110	60	77	1	0	0	0	0	no	no	no	no	no	1	2	2	1	1	75	90	NO	NO	NO	NO	NO
23	17184797	56	F	59	VENTRAL UMBILICAL HERNIOPLASTY	81	114	78	90	100	3	1	2	81	114	78	90	80	115	75	88	1	2	1	0	0	yes	yes	no	no	no	1	1	1	2	1	45	60	NO	NO	NO	NO	NO
24	17133907	48	M	66	LEFT CLAVICLE FRACTURE ORIF WITH	77	104	82	89	99	3	1	1	77	104	82	89	78	103	79	87	0	0	0	0	0	yes	yes	no	no	no	1	1	1	2	1	90	115	NO	NO	NO	NO	NO
25	17135343	44	M	73	PROXIMAL HUMERUS FRACTURE ORIF	59	129	66	87	96	3	1	2	59	129	66	87	60	128	67	87	1	0	0	0	0	yes	yes	no	no	no	1	1	1	1	1	60	80	NO	NO	NO	NO	NO
26	17197809	24	M	57	NECK OF HUMERUS FRACTURE FOR	84	109	70	83	98	3	2	1	84	109	70	83	85	110	70	83	1	2	1	0	0	yes	yes	no	no	no	1	1	2	1	1	75	90	NO	NO	NO	NO	NO
27	17157321	36	F	77	LAP CHOLECYSTECTOMY	78	127	80	96	100	3	1	1	78	127	80	96	78	125	81	96	1	2	1	0	0	yes	yes	no	no	no	1	1	1	1	1	55	70	NO	NO	NO	NO	NO
28	17168238	27	M	42	HERNIOPLASTY INGUINAL RIGHT	75	114	54	74	99	3	2	2	75	114	54	74	75	116	58	77	0	0	0	0	0	yes	yes	no	no	no	1	2	3	2	1	90	110	NO	NO	NO	NO	NO
29	17173377	21	M	64	LAP CHOLECYSTECTOMY	68	117	67	84	100	3	2	1	68	117	67	84	70	118	67	84	1	0	0	0	0	no	no	no	no	no	1	1	1	1	1	45	60	NO	NO	NO	NO	NO
30	17132861	48	M	72	VENTRAL HERNIA HERNIOPLASTY	64	107	63	78	98	3	2	1	64	107	63	78	64	108	65	79	1	1	0	0	0	yes	no	no	no	no	1	1	1	2	1	45	60	NO	NO	NO	NO	NO
31	17179685	44	F	69	LAMINECTOMY WITH EXCISION OF	58	126	82	97	99	3	2	1	58	126	82	97	59	126	80	95	0	0	0	0	0	no	yes	no	no	no	1	2	2	3	2	240	270	NO	NO	NO	NO	NO
32	17181205	45	M	54	LAP CHOLECYSTECTOMY	85	118	65	83	100	3	2	2	85	118	65	83	85	120	65	83	1	0	0	0	0	yes	yes	no	no	no	1	1	1	1	1	65	80	NO	NO	NO	NO	NO
33	17145257	34	M	45	SEPTOPLASTY FOR R DNS	83	128	71	88	99	3	2	2	83	128	71	88	83	125	70	88	1	2	1	0	0	yes	yes	no	no	no	1	1	1	1	1	55	70	NO	NO	NO	NO	NO
34	171324994	52	M	67	RIGHT TYMPANOPLASTY	79	109	68	82	98	3	1	1	79	109	68	82	79	110	70	83	1	0	0	0	0	no	no	no	no	no	1	2	3	2	1	90	110	NO	NO	NO	NO	NO
35	220323032	25	F	52	SEPTOPLASTY	68	115	64	81	99	3	2	1	68	115	64	81	68	114	65	81	1	1	0	0	0	no	no	no	no	no	1	1	1	1	1	45	60	NO	NO	NO	NO	NO
36	17176751	36	M	72	RADIUS FRACTURE ORIF PLATING	78	125	74	91	100	3	1	2	78	125	74	91	78	122	76	91	1	0	0	0	0	no	yes	no	no	no	1	2	2	1	1	70	90	NO	NO	NO	NO	NO
37	17108295	29	F	50	MTP WITH TUBAL LIGATION	72	103	76	85	100	3	1	1	72	103	76	85	72	110	75	87	1	2	1	0	0	yes	yes	no	no	no	1	1	1	1	1	55	70	NO	NO	NO	NO	NO
38	17108706	32	F	55	DIAGNOSTIC LAPAROSCOPY WITH	67	124	69	87	99	3	2	1	67	124	69	87	67	127	68	88	1	0	0	0	0	yes	no	no	no	no	1	1	1	1	1	60	90	NO	NO	NO	NO	NO
39	17149597	40	F	58	TYMPANOPLASTY RIGHT	84	113	65	81	100	3	2	1	84	113	65	81	84	118	67	84	1	1	0	0	0	yes	yes	no	no	no	1	1	1	2	1	70	90	NO	NO	NO	NO	NO
40	17181134	45	M	65	LAP CHOLECYSTECTOMY	79	106	68	81	100	3	1	2	79	106	68	81	79	110	70	83	1	2	1	0	0	no	no	no	no	no	1	1	1	1	1	55	70	NO	NO	NO	NO	NO

MASTERCHART (GROUP B- PATIENTS RECEIVINE LIGNACAINE NEBULISATION)

S. No.	UHID	Demographic Profile				GENERAL EXAMINATION								Pre Operative Vital Charting								Hoarseness (GRADE0-3)					Cough(yes/no)					Post Operative Sore Throat Assessment: Grade 1-4					Total surgical time (min)	Total anaesthesia time (min)	SIDE EFFECTS(YES/NO)				
							BP							Pre Nebulisation				15 Mins After Nebulisation																								
															BP				BP																						
		Age	Sex	Weight (kg)	Operation	HR	SBP	DBP	MEAN	SpO2 (%)	Mouth Opening (FINGER TEST)	MPG Grade	ASA Grade	HR	SBP	DBP	MEAN	HR	SBP	DBP	MEAN	30 mins	2 hrs	8 hrs	12 hrs	24 hrs	30 mins	2 hrs	8 hrs	12 hrs	24 hrs	30 Mins	2 Hrs	8 Hrs	12 Hrs	24 Hrs			Dizziness	Dry mouth	Oedema	Nausea	Weakness (Generalised)
1	17101296	38	M	55	TYMPANOPLASTY	68	122	74	90	100	3	1	1	68	122	74	90	62	118	67	84	0	0	0	0	0	yes	yes	no	no	no	1	1	3	2	2	50	60	NO	YES	NO	NO	NO
2	17114700	24	F	65	SEPTOPLASTY	72	124	68		100	3	1	2	72	124	68	87	65	104	65	78	0	1	0	0	0	yes	no	no	no	no	1	2	2	1	1	45	55	NO	NO	NO	NO	NO
3	17110588	30	F	58	SEPTOPLASTY	58	109	61	77	99	3	2	1	58	109	61	77	56	105	61	76	0	1	0	0	0	no	no	no	no	no	1	2	2	2	1	55	65	NO	YES	NO	NO	NO
4	17117508	50	M	68	MODIFIED RADICAL MASTOIDECTOMY	81	128	74	92	99	3	1	1	81	128	74	92	76	119	69	86	0	0	0	0	0	no	no	no	no	no	1	1	2	1	1	165	180	NO	YES	YES	NO	NO
5	17152630	29	M	57	LAP CHOLECYSTECTOMY	78	123	68	86	100	3	1	1	78	123	68	86	69	117	62	80	0	0	0	0	0	no	no	no	no	no	1	1	2	1	1	45	60	NO	YES	NO	NO	NO
6	17114858	28	M	56	LAP CHOLECYSTECTOMY	67	132	83	99	99	3	1	2	67	132	83	99	65	128	79	95	0	0	0	0	0	yes	yes	no	no	no	1	2	3	2	1	50	70	NO	NO	NO	NO	NO
7	17152107	25	M	72	LAP CHOLECYSTECTOMY	84	122	70	87	100	3	2	1	84	122	70	87	76	120	70	87	0	1	0	0	0	yes	yes	no	no	no	1	2	2	1	1	45	60	NO	NO	NO	NO	NO
8	17103717	25	M	65	LAP CHOLECYSTECTOMY	82	118	61	80	98	2	2	2	82	118	61	80	78	110	60	77	0	0	0	0	0	yes	yes	no	no	no	1	2	3	2	2	75	90	NO	YES	NO	NO	NO
9	17106221	32	M	63	LAP CHOLECYSTECTOMY	77	109	60	76	100	2	1	1	77	109	60	76	70	110	60	77	0	0	0	0	0	no	yes	no	no	no	2	3	3	2	1	65	90	NO	NO	NO	NO	NO
10	17157932	50	M	58	LAP CHOLECYSTECTOMY	65	118	64	82	99	3	2	1	65	118	64	82	62	108	65	79	0	1	0	0	0	yes	no	no	no	no	1	2	3	2	2	70	90	NO	NO	NO	NO	NO
11	17158407	48	M	69	LAP CHOLECYSTECTOMY	69	123	69	87	98	3	1	1	69	123	69	87	62	118	71	87	0	0	0	0	0	no	yes	no	no	no	1	2	2	1	1	65	90	NO	YES	NO	NO	NO
12	17158933	40	F	65	RIGHT BREAST ABSCESS DRAINAGE	74	130	80	97	99	2	2	2	74	130	80	97	69	128	78	95	0	0	0	0	0	no	yes	no	no	no	1	1	2	2	1	55	70	NO	YES	NN	NO	NO
13	17154698	33	F	67	LAP CHOLECYSTECTOMY	85	128	68	88	99	3	1	1	85	128	68	88	79	118	65	83	0	1	0	0	0	yes	yes	no	no	no	1	2	3	3	2	65	90	NO	YES	NO	NO	NO
14	17169160	39	M	55	LAP CHOLECYSTECTOMY	72	117	70	86	98	2	1	1	72	117	70	86	70	115	68	84	0	0	0	0	0	yes	yes	no	no	no	2	3	3	2	1	75	100	NO	YES	NO	NO	NO
15	17156625	31	F	62	LAP CHOLECYSTECTOMY	69	106	63	77	97	3	1	1	69	106	63	77	65	105	65	78	1	1	0	0	0	yes	yes	no	no	no	1	2	2	1	1	120	180	NO	NO	NO	NO	NO
16	17169442	52	F	67	GASTROJEJUNOSTOMY	82	117	71	86	99	3	2	1	82	117	71	86	79	115	68	84	0	1	0	0	0	no	no	no	no	no	1	2	2	3	2	220	240	NO	NO	NO	NO	NO
17	17181920	30	M	59	APPENDICECTOMY LAPAROSCOPIC	79	129	68	88	100	3	2	2	79	129	68	88	75	118	65	83	0	0	0	0	0	yes	no	no	no	no	1	1	2	1	1	65	90	NO	YES	NO	NO	NO
18	17188388	34	F	61	RIGHT BREAST ABSCESS DRAINAGE	74	108	59	75	100	3	2	2	74	108	59	75	70	106	61	76	0	0	0	0	0	no	no	no	no	no	1	1	2	1	1	45	60	NO	YES	NO	NO	NO
19	17181797	27	F	55	LAP CHOLECYSTECTOMY	67	115	62	80	100	2	2	1	67	115	62	80	65	110	60	77	1	1	0	0	0	no	yes	no	no	no	1	2	3	2	2	55	70	NO	YES	NO	NO	NO
20	17184341	30	F	45	LAP CHOLECYSTECTOMY	84	108	58	75	99	2	1	2	84	108	58	75	79	105	60	75	0	0	0	0	0	yes	no	no	no	no	1	2	2	2	1	60	90	NO	YES	NO	NO	NO
21	17133910	43	M	52	RIGHT ULNA FRACTURE ORIF WITH PLATING	73	118	60	79	98	2	1	1	73	118	60	79	69	116	62	80	0	0	0	0	0	yes	yes	no	no	no	2	3	3	2	1	90	120	NO	NO	NO	NO	NO
22	17135495	37	M	54	RIGHT ULNA SHAFT FRACTURE ORIF WITH SCRW FIXATION	76	122	74	90	99	3	1	2	76	122	74	90	71	120	68	85	1	1	1	0	0	no	yes	no	no	no	1	2	3	2	1	110	140	NO	NO	NO	NO	NO
23	17197331	23	M	57	LEFT CLAVICLE FRACTURE ORIF WITH PLATING	69	128	66	87	98	3	2	1	69	128	66	87	65	122	65	84	0	0	0	0	0	yes	yes	no	no	no	1	3	2	1	1	90	120	NO	NO	NO	NO	NO
24	17172190	31	M	71	LAP CHOLECYSTECTOMY	74	116	69	85	99	2	2	1	74	116	69	85	70	118	70	86	0	0	1	0	0	no	no	no	no	no	1	2	2	1	1	55	70	NO	NO	NO	NO	NO
25	17173369	36	M	69	LAP CHOLECYSTECTOMY	83	131	82	98	100	3	2	2	83	131	82	98	80	126	78	94	0	0	0	0	0	yes	yes	no	no	no	2	3	2	2	1	45	60	NO	NO	NO	NO	NO
26	17174457	36	F	66	LAP CHOLECYSTECTOMY	75	129	71	90	100	3	1	1	75	129	71	90	72	118	69	85	0	0	0	0	0	yes	yes	no	no	no	1	1	2	1	1	40	60	NO	NO	NO	NO	NO
27	17179742	36	F	65	LAP CHOLECYSTECTOMY	64	119	65	83	100	2	2	2	64	119	65	83	60	116	60	79	0	0	1	0	0	no	no	no	no	no	1	3	2	2	1	55	70	NO	YES	NO	NO	NO
28	17178808	24	F	58	LAP CHOLECYSTECTOMY	88	106	61	76	99	3	2	1	88	106	61	76	85	105	60	75	0	0	1	0	0	no	no	no	no	no	1	1	2	2	1	45	60	NO	YES	NO	NO	NO
29	17145308	46	F	52	TYMPANOPLASTY RIGHT	58	127	83	98	98	3	2	1	58	110	70	83	60	118	67	84	0	0	0	0	0	no	no	no	no	no	1	1	2	1	1	70	90	NO	YES	NO	NO	NO
30	17105325	36	M	54	SEPTOPLASTY FOR L DNS	61	117	76	90	100	3	2	2	61	117	76	90	60	115	70	85	0	0	0	0	0	yes	yes	no	no	no	1	2	2	2	1	45	60	NO	YES	NO	NO	NO
31	220324094	30	M	47	TYMPANOPLASTY RIGHT	64	122	81	95	97	3	1	1	64	122	81	95	63	121	79	93	0	0	1	0	0	yes	yes	no	no	no	1	3	2	2	1	70	95	NO	NO	NO	NO	NO
32	17108724	30	F	54	MTP WITH TUBAL LIGATION	72	109	59	76	99	2	1	1	72	109	59	76	69	110	60	77	0	0	0	0	0	yes	yes	no	no	no	1	2	2	1	1	90	120	NO	YES	NO	NO	NO
33	17109397	32	F	49	DIAGNOSTIC LAPAROSCOPY WITH HYSTEROSCOPY FOR SECONDARY INFERTILITY	66	117	69	85	99	3	1	2	66	117	69	85	61	110	61	77	0	0	0	0	0	yes	yes	no	no	no	2	3	2	2	1	120	150	NO	NO	NO	NO	NO
34	17120625	36	F	65	MTP WITH TUBAL LIGATION	79	128	73	91	100	2	2	1	79	128	73	91	73	118	67	84	0	0	1	0	0	yes	yes	no	no	no	1	2	2	2	2	45	60	NO	NO	NO	NO	NO
35	17084344	30	F	74	RIGHT TYMPANOPLASTY	82	114	64	81	98	3	1	1	82	114	64	81	79	110	62	78	0	0	0	0	0	no	no	no	no	no	1	2	2	2	1	55	70	NO	NO	NO	NO	NO
36	17145593	41	F	53	RIGHT MRM FOR RIGHT COM	62	128	72	91	100	2	1	2	62	128	72	91	59	120	68	85	0	0	0	0	0	no	no	no	no	no	1	1	2	2	1	150	180	NO	NO	NO	NO	NO
37	17150906	38	M	45	SEPTOPLASTY FOR R DNS	58	118	70	86	99	3	1	1	58	118	70	86	61	115	69	84	0	0	1	0	0	no	no	no	no	no	1	1	2	1	1	55	80	NO	YES	NO	NO	NO
38	171812665	45	M	61	LAP CHOLECYSTECTOMY	71	114	65	81	98	3	1	1	71	114	65	81	67	112	60	77	0	0	1	0	0	no	no	no	no	no	1	2	2	2	1	55	80	NO	YES	NO	NO	NO
39	171812463	43	F	65	LAP CHOLECYSTECTOMY	66	107	67	80	99	2	2	1	66	107	67	80	62	110	70	83	0	0	0	0	0	yes	no	no	no	no	1	3	2	2	1	45	60	NO	YES	NO	NO	NO
40	17183018	60	F	66	LAP CHOLECYSTECTOMY	72	129	72	91	100	2	1	2	72	129	72	91	68	118	67	84	0	0	1	0	0	yes	no	no	no	no	1	1	2	1	1	60	90	NO	NO	NO	NO	NO